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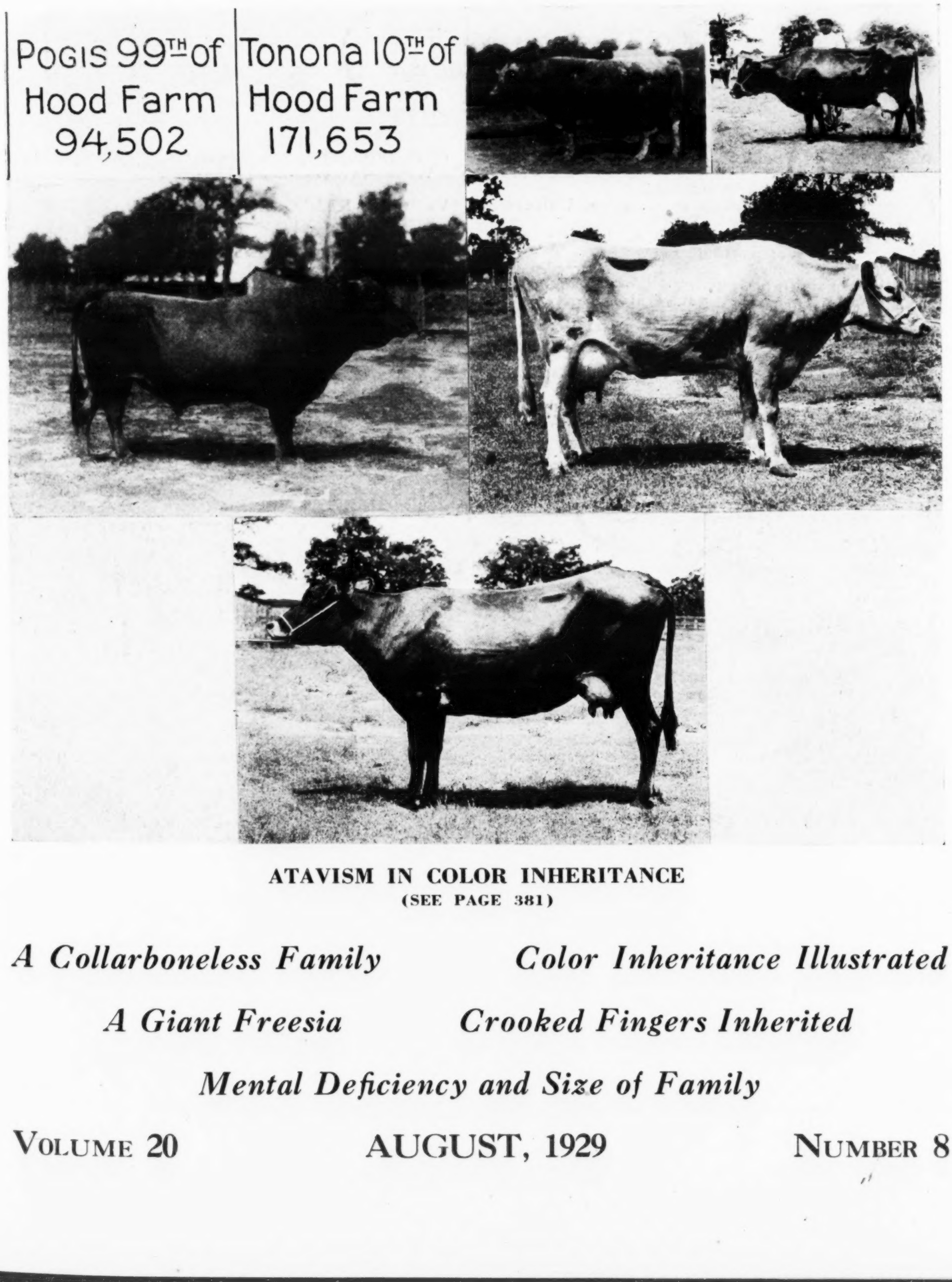
# The Journal of HEREDITY




**ATAVISM IN COLOR INHERITANCE**
(SEE PAGE 381)

*A Collarboneless Family* — *Color Inheritance Illustrated*

*A Giant Freesia* — *Crooked Fingers Inherited*

*Mental Deficiency and Size of Family*

VOLUME 20 AUGUST, 1929 NUMBER 8

# The American Genetic Association

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The

# Journal of Heredity

Vol. XX AUGUST, 1929 No. 8

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## COMING

### *Human Heredity*

**Inheritance of artistic ability—Birthrate of college graduates and their non-collegiate brothers and cousins—Inheritance of tooth defects—Indian-Nordic hybrids.**

### *Plant Heredity*

**The double pummelo—The giant cactus as a food plant—Earliness in barley hybrids—Cabbage-radish hybrids—The Totem Pole Rose.**

### *Animal Heredity*

**Zebra-horse hybrids—The Siamese cat—Breeding hen-feathered Leghorns—Inheritance of trail-barking propensity in dogs—Inheritance in bantam crosses—Dairy-cattle improvement illustrated—Combats in Animals.**

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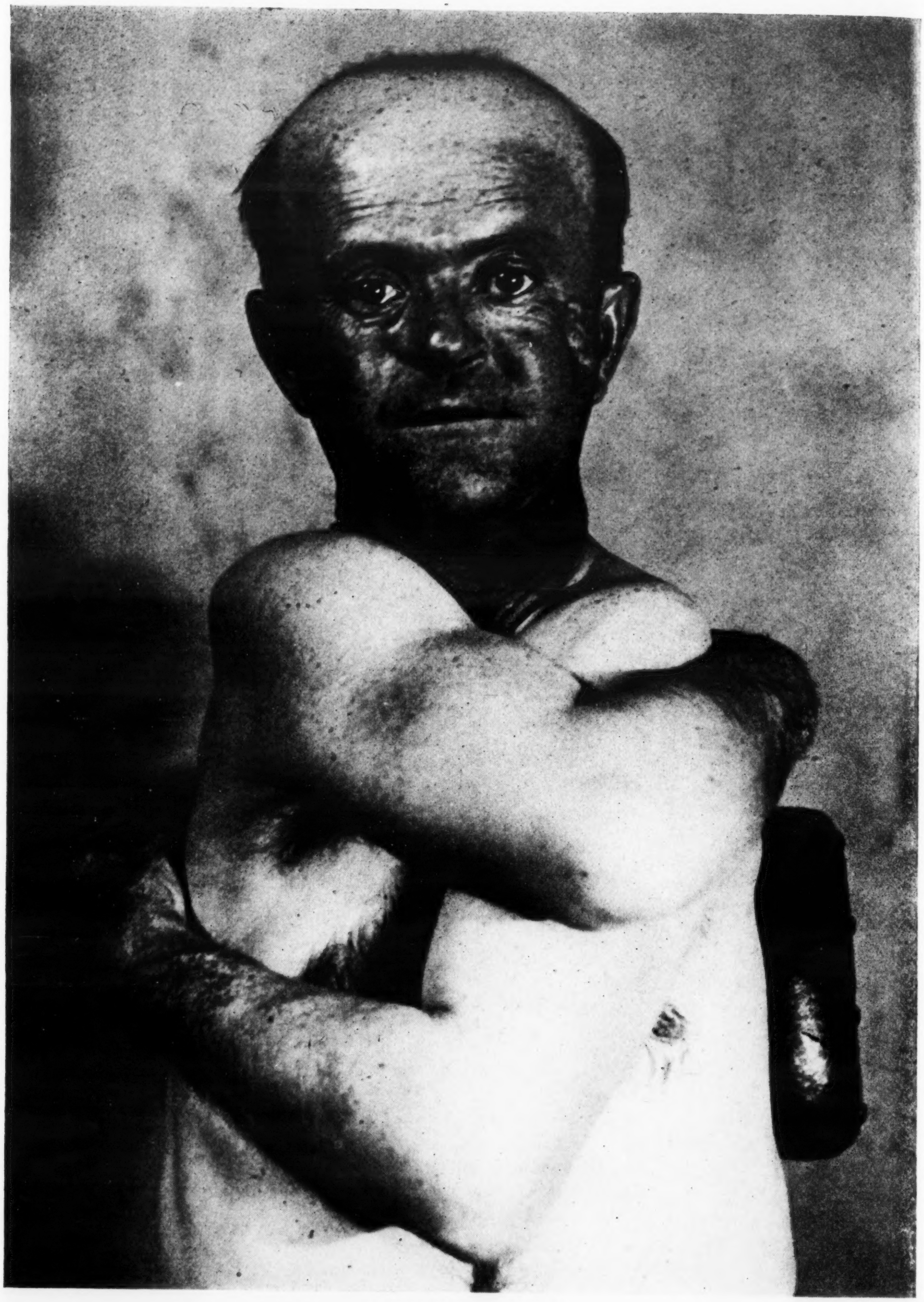


**A FOLDING MAN**

**Frontispiece**

Will the busy and crowded housewife of the future, along with folding beds, folding kitchens and folding baby-carriages, have a folding husband to match? The possibility is suggested by the heritable absence of collarbones, which makes it possible to fold the shoulders together. A serious difficulty is that cranio-cleido-dysostosis (the technical name for this condition) affects other bones than the clavicles, and even the most obliging husband might object to a soft spot on the top of his head, and to "growing pains" all his life!

# HEREDITARY ABSENCE OF CLAVICLES

ARTHUR KELLEY

THE person whose photographs appear in this paper was examined by the writer while engaged in making anthropometric studies for the Division of Anthropology at Harvard University and the Massachusetts Bureau of Mental Diseases. He is an inmate of the Kentucky Reformatory at Frankfort, Kentucky. He is thirty-six years of age and is of native, "Old American" stock.

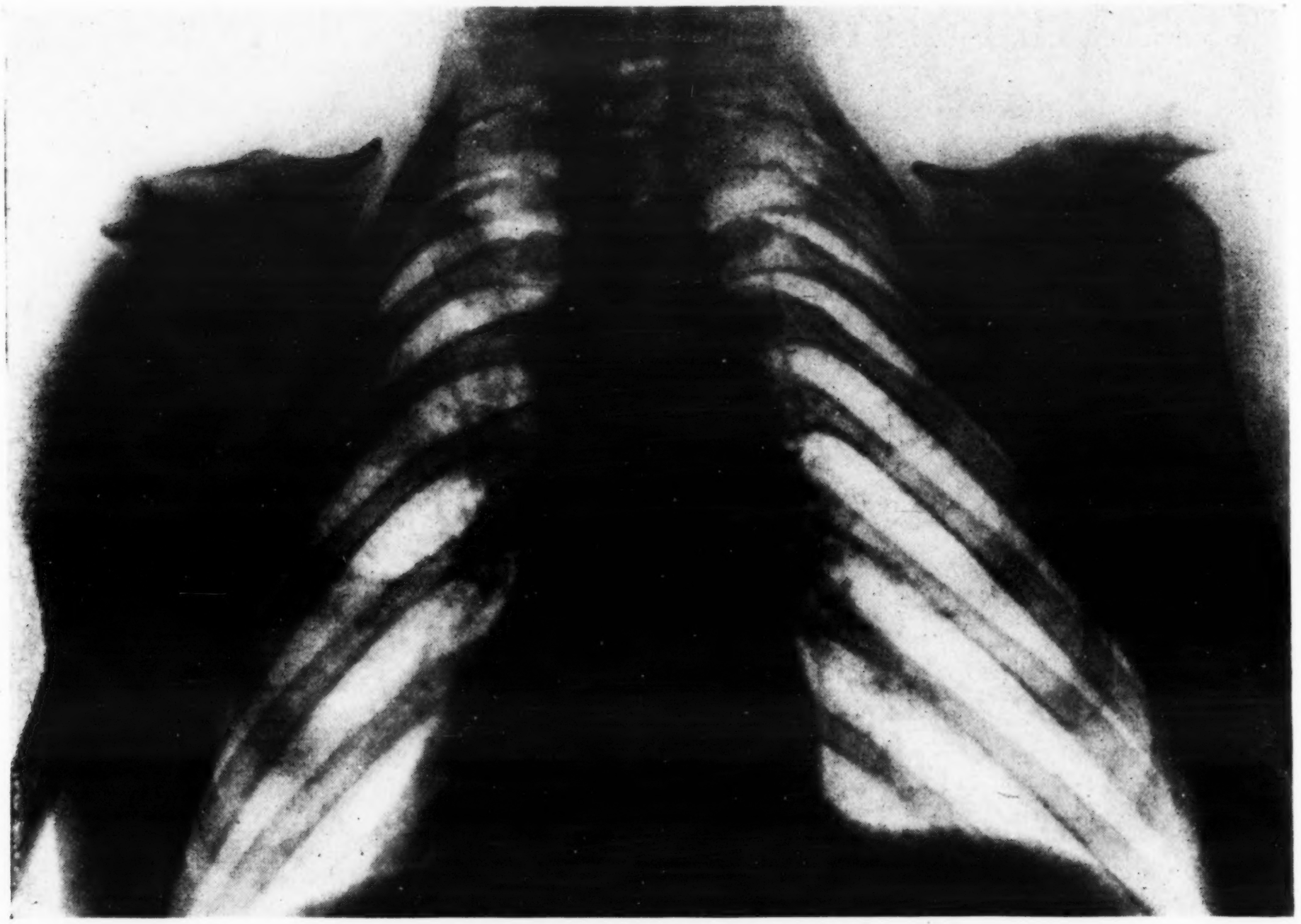
A glance at the remarkable photographs of this individual will suffice to show the unusual and rather bizarre presence of a developmental defect which has seemed to be of sufficient genetic interest to merit presentation in this journal. In Frontispiece the subject is exhibited with the shoulders brought into contact in the middle line over the sternum. This most unnatural juxtaposition is made possible by the complete, or almost total, absence of the clavicles, which, in normal individuals, act as a strut in the ventral part of the shoulder girdle to hold the arms poised at the side. At the time of examination, I sought to determine by palpation whether or not the clavicles were completely absent. Apparently they were entirely lacking. In order to gain further assurance upon this point, I applied to the medical department of the institution for assistance and am indebted to Warden H. H. Beard and the officer in charge of the hospital for the x-ray picture presented here, and for their kindness and the coöperation of the subject in giving me permission to use the data thus secured.

The x-ray photograph, reproduced in Figure 1, reveals clearly that the clavicles must be completely, or very nearly, completely absent. It is possible that an inner and outer portion of the clavicle project from the sternum and from the acromion process of the scapula. Moreover, the clavicle in this instance may be represented by a membranous ligament which would not be apparent in the x-ray picture, and which could not be distinguished from the underlying muscles by palpation.

### Associated Defects

The malformation of the clavicle represented in this case is very unusual and of especial pathological interest, but is not without parallel in medical records. Associated developmental defects give the key to the kind of pathology represented. It seems clear that we have here a case of cranio-cleido-dysostosis, a hereditary pathological condition which affects bones developed wholly or partly in membrance. Fitz-Williams has given an account of all the recorded literature upon this pathology in *The Lancet* for 1910.* The symptoms sketched by him for some sixty cases check in almost every particular with the case presented here. The clavicle may be a thin bony bar, partly cartilaginous, or may be a membranous ligament. The middle two-thirds of the bone is usually the portion which remains in the embryonic membranous condition; the bony parts of the clavicle which attach to the sternum and the shoulder girdle proper may be in place. In 40 out of the 60 cases reported, the bones of the head and face are also affected. There is both deficient and defective ossification of the bones of the skull. A globular, distended cranial vault, depressed in the sagittal line, with a bulbous forehead, is to be found in these cases. The appearance is much the same as in hydrocephalous persons. The face is small, both absolutely and relatively in comparison with the head; the suborbital region is shrunken and depressed. The malars are deflated. A marked constriction in the maxillary region of the upper face is present.

*Hereditary Cranio-Cleido-Dysostosis, D. C. L. Fitz-Williams, Lancet, 1910, V. 2, p. 1466.



**THE CLAVICLES MISSING**

**Figure 1**

In the normal individual the collarbones appear in an x-ray as a dark shadow extending from the top of the shoulder blades to a point somewhat lower in the mid-line of the chest. It is possible that a membraneous vestige of the collarbones exists that does not appear on an x-ray plate and can not be palpated, but for practical purposes the clavicles are absent.

In the records summarized by Fitz-Williams other developmental defects and abnormal conditions are associated with cranio-cleido-dysostosis. Defects of the teeth and palate occur in 19 of 60 cases. In our subject there occurs the very curious anomaly of a third set of teeth, found present and impacted, when the "permanent" teeth were removed by the dentist. The alveolar arch has the V-shape.

In the subject under discussion there occurs the ensemble of facial and cranial anomalies described by Fitz-Williams. The head is enlarged disproportionately, the breadth increasing markedly in proportion to head length to give a hyper-brachycephalic index of 91. At 36 years of age this man still suffers "growing pains" in the cranial vault. Ossification is not yet completed, and we have possibly a suggestion of "unhealed hydrocephaly".

### Other Cases in Family

From the subject I was able to secure the following facts of genetic importance. His mother was born without clavicles. She had two children, boys, the subject as described, and a brother who is said to be normal in the possession of clavicles. The brother is dead and without offspring. The only child of the subject, a girl, inherits the absence of clavicle from her father. The evidence given suggests the presence of a dominant Mendelian factor for absence of clavicles. In all probability the abnormal condition, cranio-cleido-dysostosis, is a mutation, of recent origin, initiated perhaps in the mother of the subject. The fact that the condition of malformation does

not occur in the brother of the subject is not necessarily opposed to the suggestion just made—the subject would be a dominant heterozygote for absence of clavicle. Fitz-Williams found no record of transmission through three generations, although he remarked that the hereditary nature of the "disease" was certain. He found 8 families producing 31 individuals with some degree of cranio-cleido-dysostosis. In these instances there was no evidence of sex linkage; transmission is possible from parents of either sex.

Cranio-cleido-dysostosis is an abnormal condition apparently inherited as a dominant Mendelian factor, which affects the development of the bones laid down in membrane, as opposed to achondroplasis (affecting the bones laid down in cartilage). The arrest of development from membrane to bone, and the retention of an embryonic phase of growth give opportunity for study of the developmental origin of the clavicle. Through the operation of the biogenetic phenomena, early phylogenetic connections are suggested in the developmental defects of the clavicle and shoulder girdle; and by anatomical comparisons of these phases with the structure of primitive reptiles, amphibians, and the earliest mammalian prototypes, some light may be thrown upon the question of the rôle of the clavicle in the evolution of the shoulder girdle. A complete presentation of facts bearing upon this subject would require discussion of more import to comparative anatomy than to genetics and so will be relegated to another source.

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## Science and Human Welfare

THE attitude of mind of the scientist has contributed no less than have the facts of science to the modern outlook of society. Social disharmonies are no longer regarded as the inevitable consequence of a particular model of social structure; they are looked upon as instances of imperfect organization. Man is no longer content to allow natural forces to work their will upon him. He is the rebel among living things, ever challenging nature, bending it to his will. The stage is set for the next act in the drama of social progress. We await the entrance of the leading man.

Man's dominion over nature has always depended on the plasticity conferred by intelligence and by the power of rapid learning. The future of mankind and of society will be determined by the use he makes of these. The action of the slow wasteful blind forces of natural selection has resulted in the production of the truly marvelous living mechanism. When man applied his intelligence and experience to the task of changing the characteristics of his animals and plants his achievements were secured much more rapidly than were those of nature. If he knew what he wanted, and if he wanted sufficiently ardently, he could achieve similarly rapid advances in the further evolution of his own species. So far he has avoided any project of this magnitude merely contenting himself with applying mere palliatives to the sores of social disharmonies.—F. A. E. Crew, *Scientific Agriculture*, Page 771. Vol. IX, No. 12.

**A GIANT FREESIA—APPROXIMATELY NATURAL SIZE**

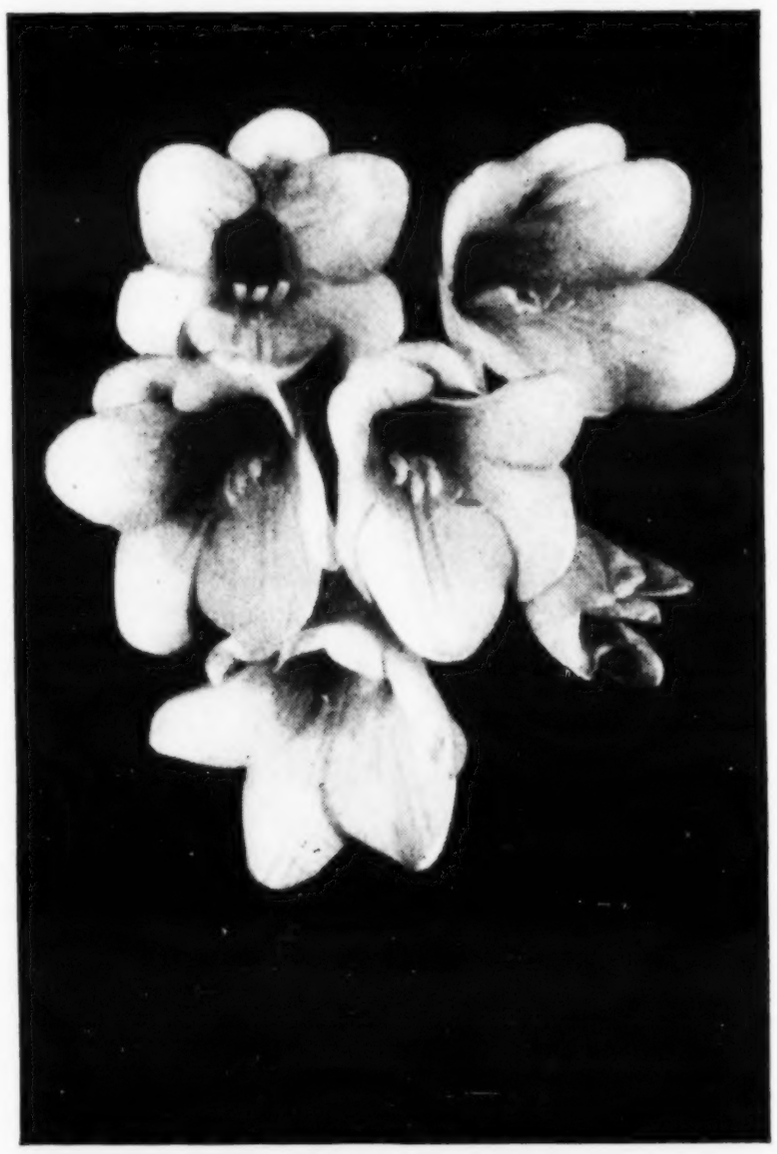
**Figure 2**

Ordinary freesia flowers, photographed in the same scale, are shown in Figure 3. This giant freesia appeared in a group of seedlings of doubtful parentage, but its behavior in crosses indicates that it is a mutation rather than a fortunate chance combination of size-factors. A cytological study in progress may reveal chromosome changes as the cause of the variation.

# A NEW VARIETY OF FREESIA

W. P. Morgan
*Indiana Central College, Indianapolis*

THE popularity of the Freesia as a "cut-flower" is increasing each year. This is in part due to its being "pushed" by the commercial grower, who finds it to be an easily grown plant that admirably fills the "gap" between Christmas and Easter, and, further, to the recognition by the flower buying public of the freesia's many excellent qualities which make it useful in many types of decoration, both alone and in combination. Growing the thousands of corms to be forced for the cut-flower trade has become an important industry in certain parts of this country, especially in the region of Santa Barbara, California. Other sections of this country seem to be suited to its culture since the principal requirements of the freesia are: a mild, moist growing season followed by a period of drought coming on as the plant matures. A few growers in this country and Europe have been successful in producing these corms in quantity under glass where conditions of temperature and moisture may be controlled.



**COMMERCIAL FREESIA FLOWERS**
**Figure 3**

In the same scale as the giant white form. These flowers are as superior in size and color to the wild freesias introduced a century ago from South Africa, as is the giant to these.

The original *Freesia refracta* which was introduced into England from South Africa early in the nineteenth century, bore small, inconspicuous, greenish-yellow, tubular flowers. The European hybridists under the leadership of the late Rev. Joseph Jacob and G. H. Dalrymple of England, and C. G. Van Tubergen of Holland have been rewarded with varieties in many colors, increased size and wonderfully improved form. During the past twenty-five years several American hybridists have gained recognition in their work with the freesia. The varieties of the late Rudolph Fischer and and Alois Frey have been the most attractive of those produced in this country, and to them and their improved flowers we owe the present popularity of this plant. The fact that there is still much room for improvement in most of the varieties in commerce has attracted the attention of several hybridists and occasionally new varieties are introduced, but these usually cause little comment except among the collectors of plant novelties.

In the commercial greenhouses of Elder Brothers of Indianapolis, Indiana, a few years ago there appeared in a bunch of mixed freesia seedlings a giant white flower that seemed to be decidedly different from anything then in commerce. The parents of these seedlings were themselves seedlings from seeds of several of the popular varieties of freesias. Some hand pollinating had been done, but most of the material was the result of the work of

the bees, hence the parentage of the new flower is obscure. The corms of this giant, white flowered plant were carefully saved and a stock developed. The flower was officially named "Elders' Giant White" and was awarded a gold medal when exhibited at the 1928 National Flower and Garden Society's show at Louisville, Kentucky. The accompanying illustrations show specimens of this giant freesia and for comparison the common small-flowered white variety which is grown in quantity in this country. Both varieties shown were pinned to a board and placed parallel to the camera so that the photograph accurately represents their relative sizes.

### Other Advantages

This new variety of freesia is lily-like in appearance and its waxy-white fioral segments lack the yellow "lip" so familiar in the common white varieties. Single flowers grown under the usual cultural conditions have measured more than two and one-half inches in diameter and three and one-quarter inches long, while the average diameter of the flower is more than two and one-quarter inches. The growth is sturdier and the leaves darker and broader than in any variety tested. The corms average much smaller in size than those of any variety observed, although very small cormels produced large, short-stemmed flowers late in the season. Medium-sized corms produced the best plants and largest blossoms. Increase in the corms in this freesia is several times that of any other variety grown under similar conditions. Single clusters taken while the bulbs were being harvested numbered as high as thirty-seven corms of various sizes which had developed from medium-sized stock planted the preceding August. In this variety the production of cormlets in clusters in the leaf axils is very high. Even under the most adverse conditions of growth the blossoms of the Giant White attained a size and texture superior to that of the best-grown commercial varieties. The fragrance, which resembles that of orange blossoms, is more subdued than that of most freesias. In consideration of the above characteristics there is no doubt that this giant white variety represents a distinct "break" in freesias. It has been suggested that this flower is probably a mutation and this conclusion is strengthened by the results of crosses that have already blossomed.

Although I have been studying freesias for some time and rather intensively for the past two years, I am not yet prepared to report on the classification of characters or their method of inheritance. A quantity of material is being prepared for cytological study and it is possible that this source of data will yield interesting results. It is hoped that this "break" in freesias will increase the interest in this deservedly popular flower and result in an exchange of data by those seriously engaged in its improvement.

# THE INHERITANCE OF BLACK AND WHITE IN ROSE COMB BANTAMS

## A Pioneer Cross in Poultry Genetics, Illustrated by Photographs

MORLEY A. JULL, *Senior Poultry Husbandman*
JOSEPH P. QUINN, *Chief Scientific Aid*
*Bureau of Animal Industry, U. S. Department of Agriculture*

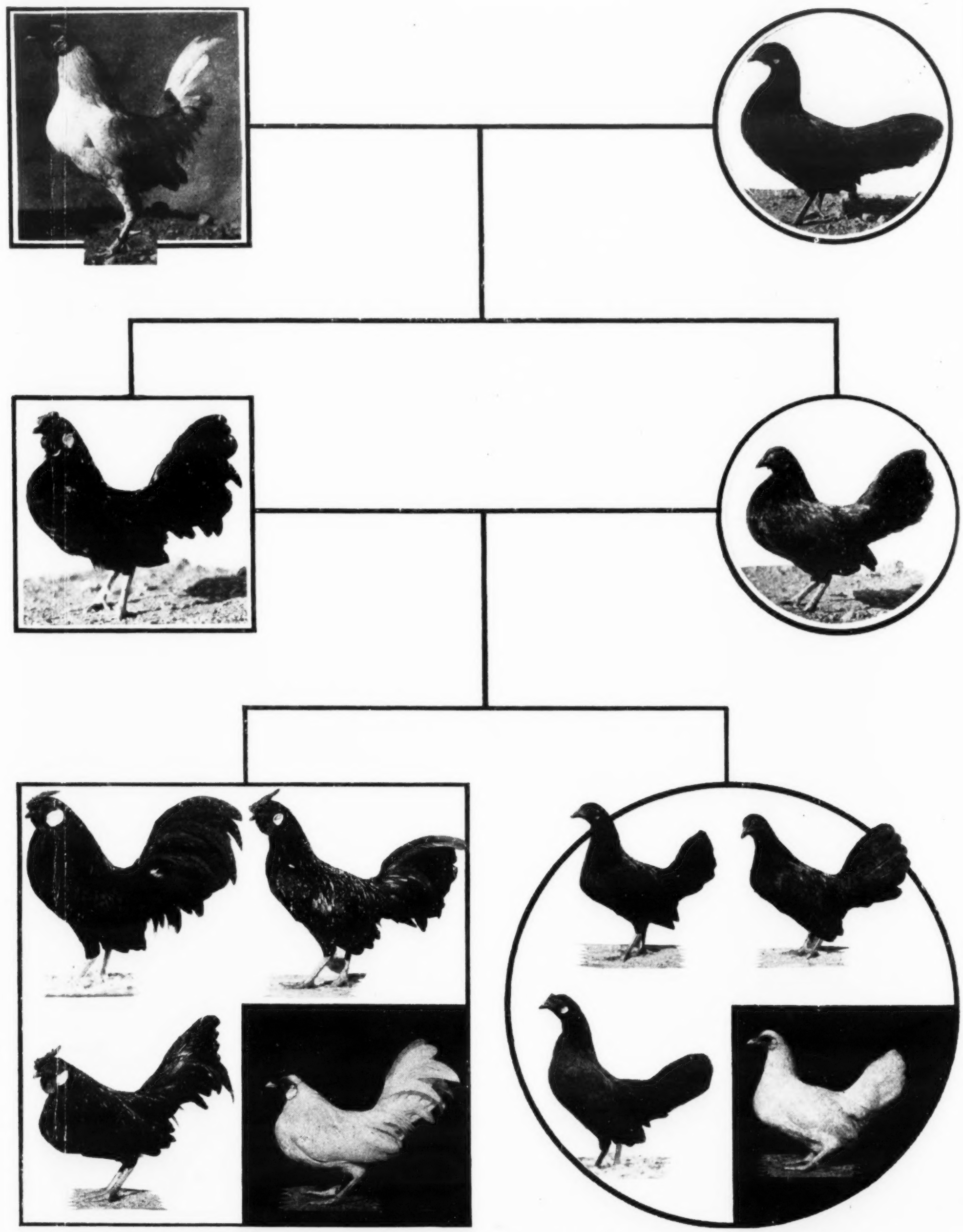
*A PHOTOGRAPHIC record of this cross is justified for two reasons. The historic value of such a record is considerable, when it is remembered that this cross represents one of the first evidences of Mendelian inheritance in the animal kingdom, and photographs of birds actually used in making such a cross have never been shown, as far as we are aware. The original cross was made over twenty years ago, but the majority of American poultrymen still apparently doubt the validity of the fundamental principles of Mendelian inheritance. Some two years ago the editor of a leading poultry journal expressed the opinion that he would never believe the results as first reported until he had talked face to face with the man who made the crosses. Within the past year one of the most prominent breeders of poultry in the United States expressed the opinion that not for a thousand years would practical poultry breeders take much stock in the gene and its bearing on heredity. It is hoped that the publication of these photographs will serve to call attention to the fact that many characters in the fowl are known to be inherited in Mendelian fashion, and that the number of these is constantly increasing.—Editor.*

THE manner in which the characters black and white are inherited in a cross between Rose-Comb Black and Rose-Comb White Bantams will serve to illustrate the mechanism involved in the inheritance of most pairs of characters. The first, and, so far as can be determined, the only reference to such a cross having been made, is reported by Bateson and Punnett in 1908.[4] The same authors[3] reported that the white of the Rose-Comb White Bantam is recessive to color. They mated Rose-Comb Black Bantams to Rose-Comb White Bantams and secured black progeny only. They mated three of the $F_1$ black females to one of the $F_1$ black males and secured 70 black and 24 white progeny. This approximates very closely a ratio of three blacks to one white and is in accordance with the Mendelian inheritance of dominance and recessiveness between a pair of characters and the segregation of the characters in the second hybrid generation.

The results of reciprocal crosses involving Rose-Comb White and Rose-Comb Black Bantams, two standard varieties described in the American Standard of Perfection,[10] secured at the U. S. Animal Husbandry Experiment Farm, Beltsville, Maryland, are given, together with photographs of birds used in the various matings.

In the spring of 1927 one pen of five Rose-Comb White Bantam males mated to seventeen Rose-Comb Black Bantam females produced 107 progeny, all of which were black. During the same breeding season another pen of two Rose-Comb Black Bantam males mated to five Rose-Comb White Bantam females produced 39 progeny, all of which were black.

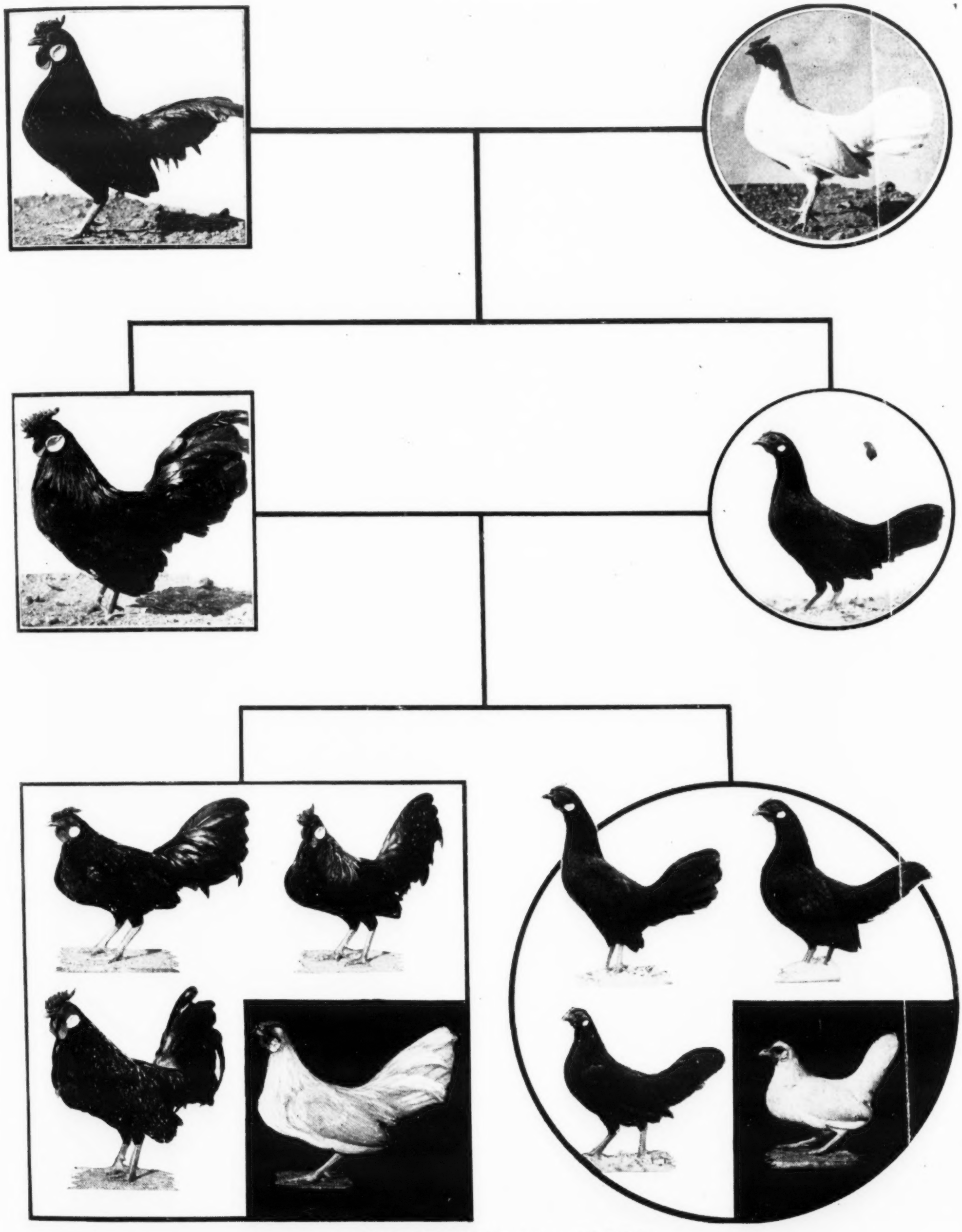
It will be observed that both crosses produced black progeny, demonstrating that in this particular cross black is dominant to white. It should be noted, however, that in the case of the second cross, Rose-Comb Black males mated to Rose-Comb White females, the male




**A PHOTOGRAPHIC INHERITANCE CHART OF A BANTAM CROSS**

**Figure 4**

Mating white bantam roosters and black hens (the $P_1$ generation) produces in the next generation ($F_1$) hybrid offspring all of which are as black as the black parent. Mating these black hybrid birds among themselves produces the second hybrid generation ($F_2$), in which the white reappears in one-quarter of the offspring. White is the *recessive* character which does not appear if the individual carries also the *dominant* gene for black. The white *segregates* which appear in the second generation are pure for white and bred among themselves will produce no black offspring. Two of the blacks out of three will be *carriers* of white, while one will be pure. These can only be distinguished by the breeding test.



THE RECIPROCAL CROSS

**Figure 5**

Mating black males and white females produces a similar result: a black hybrid generation ($F_1$) and a 3:1 segregation of black and white in the second generation ($F_2$). In this cross there is also a sex-linked trait, in the red-laced hackle feathers of the hybrid males. The factor for these is carried by the white females, but is transmitted only to their sons. This factor is independent of the black ground-color, and does not affect the ratio of black and white offspring in the next generation. Such sex-linked traits are a special case of Mendelian inheritance. Their behavior is quite different from antosomal (not sex-linked) characters. It is equally regular and can be explained by peculiarities of the sex-chromosomes. The actual number of individuals involved in these crosses is given in Table I.

progeny had hackles which were laced with red, as shown in Figure 5. This represents a case of sex-linked inheritance, the red lacing of the hackle feathers of the males having been transmitted from the Rose-Comb White females to their black-feathered sons. This matter will not be discussed further because it does not affect the main situation, namely, the inheritance of black and white as a simple pair of characters.

During the breeding season of 1928 two matings were made. The first mating consisted of the black brothers and black sisters from the first mating of 1927, Rose-Comb White males and Rose-Comb Black females. Observations were made on the color of the chicks that died in the shell at hatching time as well as those which hatched and matured. Among the chicks that died in the shell there were 81 black and 24 white chicks. Among the chicks which hatched and matured there were 189 black and 65 white chicks. Among the total progeny of the first mating, therefore, there were 270 black and 89 white chicks, a ratio approximating closely 3 to 1.

The second mating made in 1928 consisted of the black brothers and black sisters from the second mating of 1927, Rose-Comb Black males and Rose-Comb White females. Among the chicks that died in the shell at hatching time there were 21 black and 9 white chicks. Among the chicks that hatched and matured there were 29 black and 9 white chicks. The total progeny of the second mating, therefore, gave 50 black and 18 white chicks, again a fairly close approximation of a 3-to-1 ratio.

Both matings made in 1928 gave 320 black and 107 white chicks, almost exactly a 3-to-1 ratio. The results are shown in Table 1.

The results secured in this simple experiment involving one pair of characters should demonstrate to the practical poultryman two important features. First, it should be observed that in this particular cross black is dominant to white. Second, it should be observed that there has been a segregation of the characters in the proportion of 3 to 1, the larger the number of progeny secured the more nearly the approximation to a definite 3-to-1 ratio. Similar results have been secured in the case of hundreds of other pairs of characters, both in plants and animals. For information concerning results secured in poultry breeding work the poultryman is referred to Punnett[8], Lippincott[6], and Jull[5].

The poultryman should not get the idea, however, that in all cases of black and white crosses in poultry black is dominant to white, because the reverse is the case in the cross between White Leghorns and Black Leghorns, white in this cross being dominant to black. Atkinson and Curtis[1] speak of the prepotency of White Leghorn males for plumage color in the case of a cross between a White Leghorn male and a Barred Plymouth Rock female. The chicks secured from this mating were all white, which is in accordance with expectations, since the white of the white Leghorn is dominant to

**Table 1—The results secured in reciprocal crosses between Rose-Comb Black and Rose-Comb White Bantams, 1928**

| KIND OF MATING | | No. black progeny | No. white progeny | Proportion (Black : 1 White) |
|---|---|---|---|---|
| Sons mated to daughters of 1927 mating of White males and Black females. | *Died in shell* | 81 | 24 | 3.375 |
| | *Hatched* | 189 | 65 | 2.908 |
| | Total | 270 | 89 | 3.034 |
| Sons mated to daughters of 1927 mating of Black males and White females. | *Died in shell* | 21 | 9 | 2.333 |
| | *Hatched* | 29 | 9 | 3.222 |
| | Total | 50 | 18 | 2.778 |
| Totals from both matings | | 320 | 107 | 2.991 |

olor. The inheritance of various kinds f white in poultry is discussed by erebrovsky[11]. A knowledge of the anner in which the segregation of a air of characters occurs is of vital imortance to a proper understanding of the mechanism of inheritance. Poultry breeders will find a complete discussion of the problem in works by Morgan[7], Sinnott and Dunn[9], and Babcock and Clausen[2].

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## *Eugenic Laws Not the Solution*

MANY of the so-called eugenics laws are not related to real genics at all, others are either mature or have some technical flaw hich invalidates them. Before legistion there must be education of the telligent portion of the community. e cannot expect the public to deand the enforcement of a law which does not understand. Besides, a ge part of the eugenics program is tside of the realm of the law and never be touched by legislation. It matter of morality, home life, the aring and rearing of children, of rriage choice, and of love, much more than it is a matter for drastic legislation.

The eugenicist who believes in getting things done by passing laws will succeed as well as the father who seeks to rule his household by "laying down the law." Some laws are needed, it is true, because there are those who can never be reached by any other means, but for the most of us eugenics must make its appeal to reason or persuasion rather than to force as represented by law; it must prove that it is altruistic and kindly; that it is working in the interest of real charity which prevents rather than palliates;

it must demonstrate that it seeks the greatest good for the greatest number; it must convince the public that its principles are in accord with right, justice, and with current religious beliefs.

General Recommendations. 1. The public needs to be convinced that the personality of the individual is not to be violated by the eugenical measures; no forced marriages will be recommended; no "human stock farm" methods or experiments tolerated; no "free love" propaganda or legalized sex relations outside of the family advocated.

2. The laws of heredity and sociology must be determined by research and as far as is possible made the common knowledge of the masses. Every agency of instruction and morality should assist in this vast program.

3. The racial poisons need to be controlled.

4. Bad blood must be controlled and the waste of good blood checked.

5. The differential birth rate should be reversed.

6. Sex education and the practice of sex hygiene will solve many problems.

7. Immigration needs to be carefully studied and controlled accordingly.

8. It is to be hoped that the marriage relation may be stabilized.

9. It is possible that the selection of marriage mates may be rationalized to some extent without destroying romance, and that in this way many of the dire mistakes may be avoided. For this purpose careful family records are needed.

10. It is most expedient that the social and economic problems which beset the race be solved insofar as it is possible.

11. The way of opportunity for those carrying the best germ plasm to go far must be kept open and enlarged, so that they may utilize the superiority that is their heritage.

12. Customs and habits which are more conducive to the welfare of the race are badly needed.

13. Laws based upon sound biological and sociological principles will be in order when the public is sufficiently well informed and sympathetic to demand their enforcement.

We understand that this is an immense program, highly idealistic and very far from attainment. If a given individual cannot endorse all of it, then he may bend his efforts to the accomplishment of some portion of it; if we cannot hope to bring it all to successful conclusion we can do no less than tackle the problem in its easier phases.

Perhaps the word "eugenics" might better be dropped. It is a good term, but has been so much maligned and misrepresented that there is a tremendous prejudice against it. The word is often received by otherwise reasonable persons with disgust, or with an indulgent smile and shrug of the shoulders. The term in its original and strict sense is not broad enough to include the numerous phases which are now grouped about the subject. We have the terms "personal hygiene," "sex," "school," "social," "mental" and "moral" hygiene. Why not the terms "race" or "racial hygiene"? In fact, these names are being used more and more, and are much more to the point than the term "eugenics," because much that is commonly regarded as eugenics and is quite important to the welfare of the race is really quite separate.

From *Racial Hygiene*, by Thurman B. Rice. Pages 357-360. New York, The Macmillan Co., 1929.

# INTELLIGENCE AND SIZE OF FAMILY

## Survey of 10,455 Retarded Children in the Public Schools of Massachusetts*

NEIL A. DAYTON

*Director of Division of Mental Deficiency, Massachusetts Department of Mental Diseases*

IN 1915 the first traveling psychiatric school clinic in Massachusetts was operated from the W. E. Fernald State School. By 1921 fourteen such clinics were in operation and in 1928 the fifteenth was added. By means of the traveling clinics a comprehensive psychiatric examination was provided for all retarded school children. This examination covered ten different fields, including the mental, physical, pedagogic, psychologic and social aspects. Approximately 6000 examinations per annum are now being conducted by the clinics, and up to the present date about 30,000 children have been examined. The following paper reports the findings in reference to Size of Family resulting from a study of the first 10,455 examinations conducted by two of the clinics.†

The examinations in this study have been used to test the following commonly accepted theory: That the mentally defective tend to have large families.

### Intelligence of Children Examined

To avoid the possibility of mixed classifications insofar as intelligence was concerned, it was first necessary to divide the examinations according to intelligence groupings, as outlined in Figure 6 and Table I. Consequently, the retarded children examined were divided into two groups, by sex, (1) those with an intelligence quotient above .70 and (2) those with an intelligence quotient below .70. It will be observed that 6,671 males and 3,739 females, or relatively twice as many boys as girls, were examined during the period of this study. This striking difference will be discussed in other publications.

In Figure 6 and Table I, it will be noticed that the total number concerned is 10,455. In all other graphs and tables, however, the forty-five unknown I. Q.'s are omitted, making a total of 10,410 cases under discussion throughout the remainder of the paper.

It is not necessary to go into the question of the validity of present-day criteria in measuring mental ability. The Stanford Revision of the Simon-Binet, which was used in all tests, will give a rough estimate of what we are pleased to call "intelligence" at the present date. We know that within twenty-five years the 1928 conception of intelligence will be the "one-hoss shay" of psychology, and so must be satisfied with approximations in view of the non-permanence of our material.

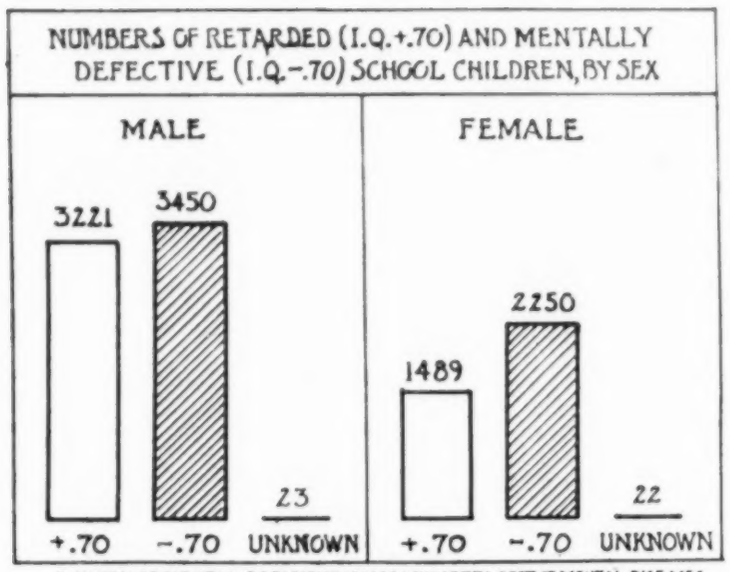
Before the matter of size of family could be gone into, it became necessary to first investigate the nativity of the mother for reasons of definite biologic import.

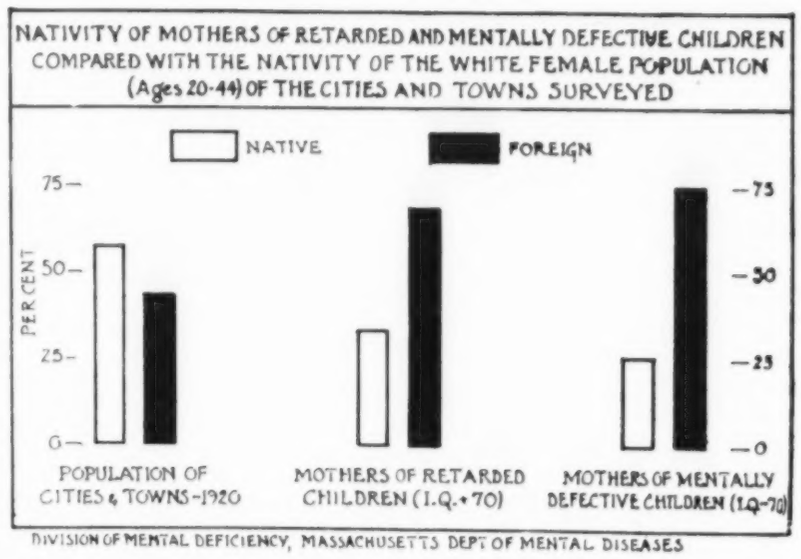
### Nativity of Mother

It is generally known that there is a difference between the number of

*Massachusetts Department of Mental Diseases, Statistical Research Project No. 1, Article VI. The writer was aided in the preparation of this paper by Eleanor Grenfell, A. B., and Helen H. Dolan, B. S., Assistants in Research, D. M. D.

†These examinations were made by the clinics in charge of Dr. Esther S. B. Woodward of the W. E. Fernald State School and Dr. Alice M. Patterson of the Wrentham State School for the years 1921-1927. Drs. Ransom A. Greene and George L. Wallace, Superintendents of these schools, have been very coöperative in rendering available to the Department the records of their travelling school clinics.





NATIVITY OF MOTHERS OF RETARDED AND MENTALLY DEFECTIVE CHILDREN COMPARED WITH THE NATIVITY OF THE WHITE FEMALE POPULATION (Ages 20-44) OF THE CITIES AND TOWNS SURVEYED
NATIVE
FOREIGN
PER CENT
75
50
25
0
POPULATION OF CITIES & TOWNS-1920
MOTHERS OF RETARDED CHILDREN (I.Q.+70)
MOTHERS OF MENTALLY DEFECTIVE CHILDREN (I.Q.-70)
DIVISION OF MENTAL DEFICIENCY, MASSACHUSETTS DEPT OF MENTAL DISEASES

## NUMBERS OF CHILDREN AND NATIVITY OF THEIR MOTHERS

**Figures 6 and 7**

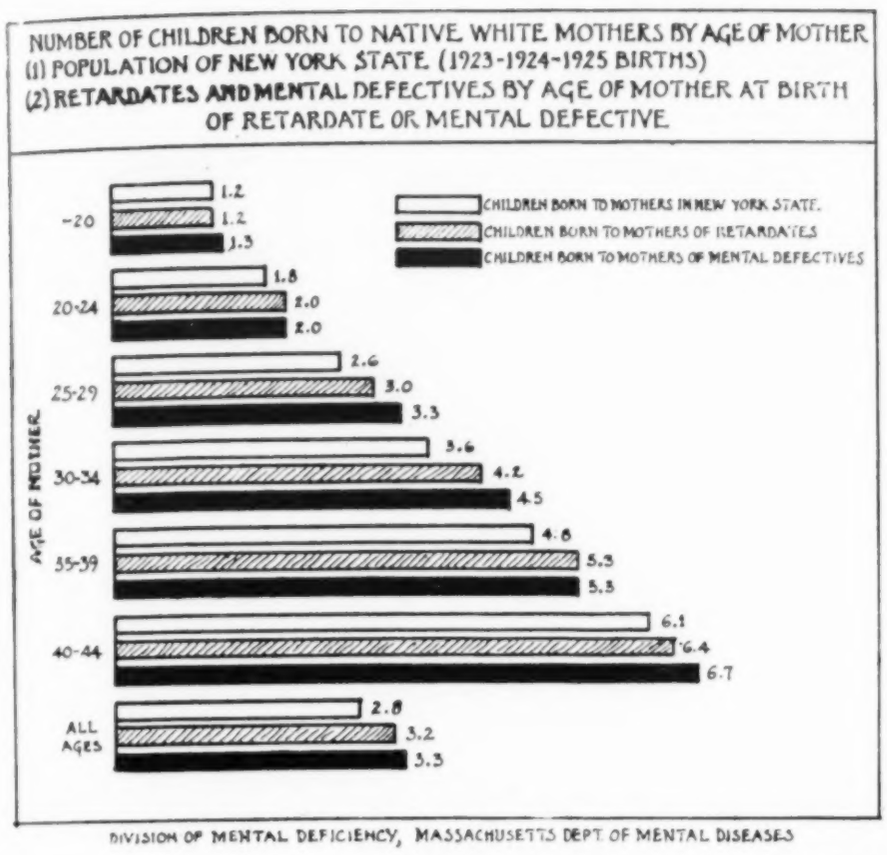
In the group of 10,455 children examined there were 6,671 males and 3,739 females. The mothers of the retarded and mentally defective group were predominantly foreign-born, although in community as a whole the women were predominantly native-born. This is partly accounted for by the larger size of the foreign families.

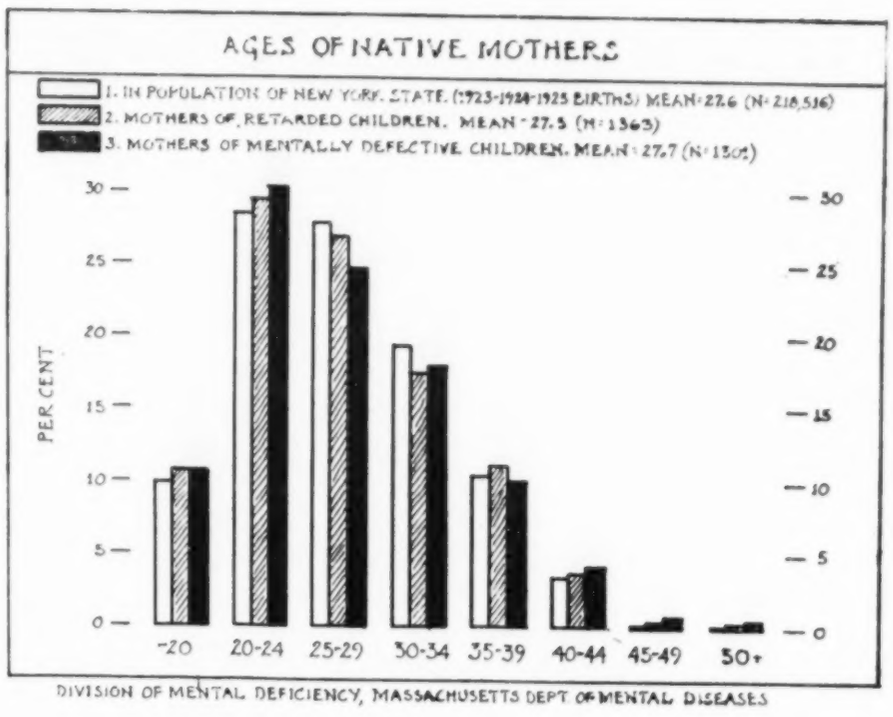
children born to native and foreign-born mothers, in that the foreign-born produce about one child more per family. Inquiry into this factor in our material showed that native-born mothers were decidedly in the minority in both groups. The question then arose: Is this an abnormal distribution for Massachusetts? Do the native and foreign-born in the general population balance in this way? To answer this, it was necessary to obtain the numbers of native-born and foreign-born white females (ages 20-44) in the population of the towns surveyed, and make a comparison with the nativity of the mothers in our group. Figure 7 and Table II give these figures from the 1920 census, with adjustments for villages. It would have been preferable to use the 1910 census, as these children were born between 1910 and 1920, but the figures were not available. The 1910 figures would have given a smaller percentage of foreign-born women of the age period under discussion, and would have made the contrast even more striking. By using the more conservative 1920 figures, it was found that the foreign-born females, aged 20-44, comprised 43 per cent of the total female population of a corresponding age in the towns surveyed. When considering the foreign-born mothers of retardates and mental defectives in our groups, however, we found that these percentages had increased to 68 and 75 respectively.

There are several elements which should be considered in this connection. The foreign-born mothers of the towns surveyed have had more children than the native mothers, and therefore the chance of having a child fall in one of our groups is greater. Also, the child from a non-English speaking home has obvious difficulties that are not encountered by children of native parents. He may be retarded in school because of social, economic or personal difficulties, not necessarily dependent upon intelligence. At the same time, it must be remembered that over 70 per cent of the children considered in this study were *three years* retarded. The average child from a foreign home would probably have adjusted to the language difficulty within a three-year period. An attempt to make an adjustment for these factors resulted in a correction of approximately 5 per cent.

### Size of Family

The question of the size of family was the third point investigated. We wished to ascertain whether or not the feeble-minded had larger families. This question was difficult to answer. Inasmuch as we had examined the children


NUMBER OF CHILDREN BORN TO NATIVE WHITE MOTHERS BY AGE OF MOTHER
(1) POPULATION OF NEW YORK STATE. (1923-1924-1925 BIRTHS)
(2) RETARDATES AND MENTAL DEFECTIVES BY AGE OF MOTHER AT BIRTH OF RETARDATE OR MENTAL DEFECTIVE
CHILDREN BORN TO MOTHERS IN NEW YORK STATE.
CHILDREN BORN TO MOTHERS OF RETARDATES
CHILDREN BORN TO MOTHERS OF MENTAL DEFECTIVES
AGE OF MOTHER
-20 1.2 1.2 1.3
20-24 1.8 2.0 2.0
25-29 2.6 3.0 3.3
30-34 3.6 4.2 4.5
35-39 4.8 5.3 5.3
40-44 6.1 6.4 6.7
ALL AGES 2.8 3.2 3.3
DIVISION OF MENTAL DEFICIENCY, MASSACHUSETTS DEPT OF MENTAL DISEASES


AGES OF NATIVE MOTHERS
1. IN POPULATION OF NEW YORK STATE. (1923-1924-1925 BIRTHS) MEAN=27.6 (N=218,516)
2. MOTHERS OF RETARDED CHILDREN. MEAN=27.5 (N=1363)
3. MOTHERS OF MENTALLY DEFECTIVE CHILDREN. MEAN=27.7 (N=1301)
PER CENT
30
25
20
15
10
5
0
-20 20-24 25-29 30-34 35-39 40-44 45-49 50+
DIVISION OF MENTAL DEFICIENCY, MASSACHUSETTS DEPT OF MENTAL DISEASES

## FAMILY-SIZE AND AGE OF NATIVE MOTHERS

**Figures 8 and 9**

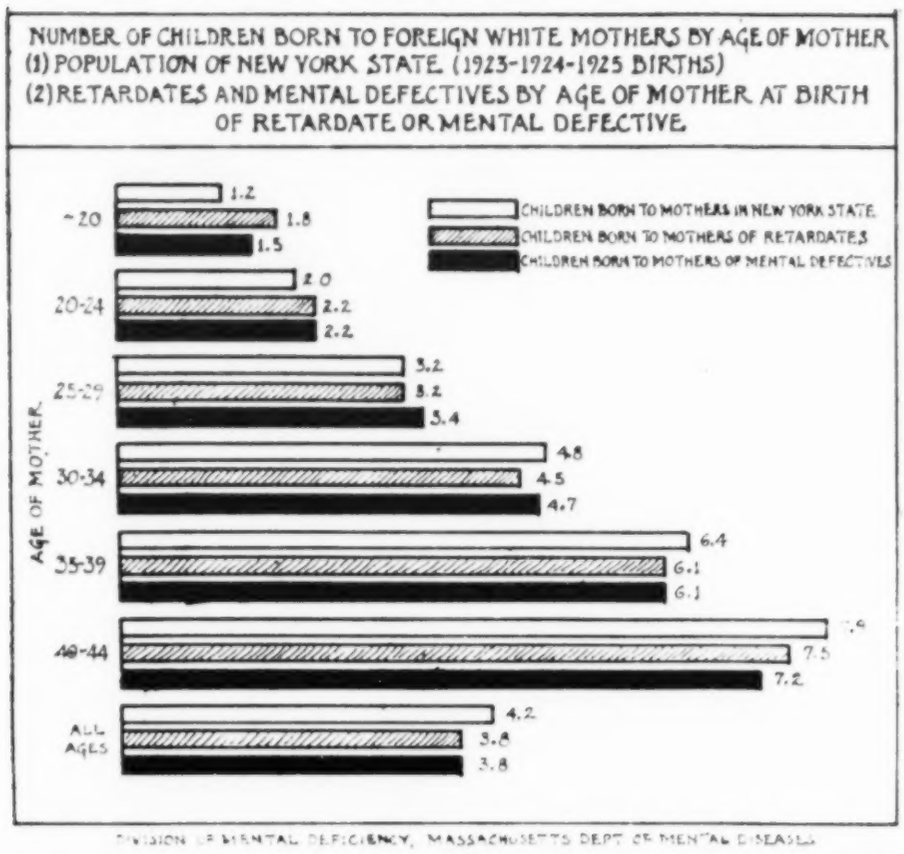
The group under investigation is compared with a homologous group in the general population of New York State, for the years 1923-25, as a control. The number of children born to the mothers of retarded and defective children is consistently larger than in the control group. The percentage of mothers in the various age groups is not consistently different.

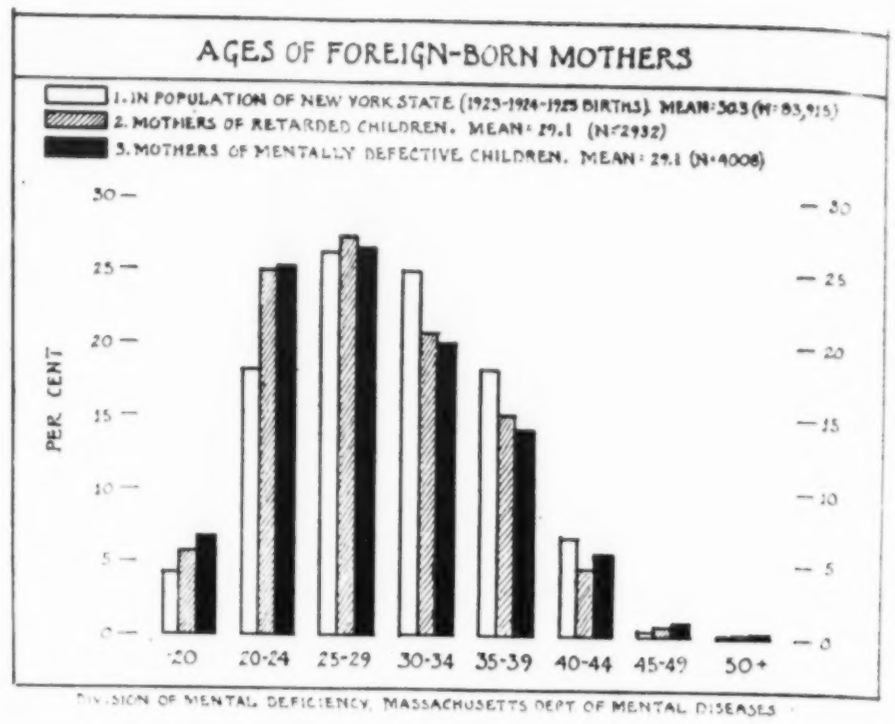
and *not* the parents, how were we to select the parents who were mentally defective? We were left to depend upon the social workers, school nurses and teachers who had visited the homes and rendered *opinions* as to the mental condition of the parents interviewed. Most of the items covered in the histories of our cases were based on facts and could be accepted. But this one factor was based on personal opinion. Reliable as our present workers are, they are neither psychiatrists nor psychologists, and we ask too much when we expect an accurate diagnosis based on a few moments' conversation. The certainty of variation is overwhelming.

To temporarily lay aside our impressionistic data and build on a factual basis, it became necessary to restate the question in this form: Are the families having a retarded or mentally defective child larger than the ordinary run of families in the general population?

In determining the size of family we are offered two methods of approach: (1) to compare a group which is in various stages of completion with another group which is in various stages of completion; (2) to select mothers who are forty-five years of age or more, consider these families as completed, and observe the number of children born to these completed families. We will use method (1) to compare our groups of incomplete families with another group of incomplete families. That is, certain families in our groups having one or two children have not had the opportunity to have more because of the age of the mother. These families will be balanced by families in the other incompleted group which have had but one or two children, provided that the distribution of the ages of the mother is approximately the same in both groups. This factor must be carefully considered. While the individual age groups will not be influenced by lack of symmetry the total number born for all ages will vary in accordance with the ages of the mother.

For comparison, the 1923, 1924 and 1925 reports of "Order of Birth by Age of Mother" from the New York State Vital Statistics were selected. As no children considered in our study came from Boston, and the New York reports were exclusive of New York


NUMBER OF CHILDREN BORN TO FOREIGN WHITE MOTHERS BY AGE OF MOTHER
(1) POPULATION OF NEW YORK STATE. (1923-1924-1925 BIRTHS)
(2) RETARDATES AND MENTAL DEFECTIVES BY AGE OF MOTHER AT BIRTH OF RETARDATE OR MENTAL DEFECTIVE
CHILDREN BORN TO MOTHERS IN NEW YORK STATE
CHILDREN BORN TO MOTHERS OF RETARDATES
CHILDREN BORN TO MOTHERS OF MENTAL DEFECTIVES
AGE OF MOTHER
~20 1.2 1.8 1.5
20-24 2.0 2.2 2.2
25-29 3.2 3.2 3.4
30-34 4.8 4.5 4.7
35-39 6.4 6.1 6.1
40-44 7.5 7.2
ALL AGES 4.2 3.8 3.8
DIVISION OF MENTAL DEFICIENCY, MASSACHUSETTS DEPT OF MENTAL DISEASES


AGES OF FOREIGN-BORN MOTHERS
1. IN POPULATION OF NEW YORK STATE (1923-1924-1925 BIRTHS). MEAN: 30.3 (N=83,915)
2. MOTHERS OF RETARDED CHILDREN. MEAN: 29.1 (N=2932)
3. MOTHERS OF MENTALLY DEFECTIVE CHILDREN. MEAN: 29.1 (N=4008)
PER CENT
50
25
20
15
10
5
0
~20 20-24 25-29 30-34 35-39 40-44 45-49 50+
DIVISION OF MENTAL DEFICIENCY, MASSACHUSETTS DEPT OF MENTAL DISEASES

## FAMILY-SIZE AND AGE OF FOREIGN MOTHERS

**Figures 10 and 11**

In the foreign group the number of children born to the older mothers of deficient children tends to be smaller than the number born to older mothers in the control group. The factors producing this restriction are not known.

City, it was possible to compare non-metropolitan Massachusetts with non-metropolitan New York. To preserve the comparison, our groups were taken at the time of the birth of the retarded or mentally defective child by age of mother. That is, births were compared with births, and note was made of the size of the families of the two groups at the time of the birth. The present status of the families could not be compared as to size for the reason that our families were older than the families having a child born in 1923, 1924, and 1925. Consequently, our average number of children born was larger than that of the New York group. However, if our figures are taken back to the time of the birth of the retarded or mentally defective child, all the children who have been born afterwards are automatically withheld from that family. In this way our group is placed in the same class with the report of births of any other group, irrespective of time. We preserved the size of the family at the birth of that particular child by age of mother.

It is to be remembered at this point that there were no consistent differences in order of birth.[1] It can be seen that if the retardates or mental defectives tended to come late in the family, the family would automatically be larger at any selected age of the mother. If the retardates or mental defectives tended to come early, the family would be smaller than should be the case. Insofar as the retardate or mental defective was not markedly displaced in the order of birth, there is no reason to believe that his average position should greatly affect the size of the family at his birth.

Figure 8 and Table III show the number of children born by age of native mother. Quite uniformly in each age-of-mother group there are more children born to native mothers in our group, than to native mothers in the population of New York State. Families having a retardate are larger than the average families in the general population and families having a mental defective are still larger. That is, for each age of mother we see a consistent difference. In the totals for all ages there is also a substantial difference.

Figure 9 and Table IV give the ages of the native mothers of our groups compared with the New York groups.

There is very little disturbance in the various age groups and the means are practically identical. Quite incidentally this throws considerable light on the oft-repeated contention that the mentality defective are born to very young or very old mothers. There is no indication from this material that the ages of the native mothers of retardates or mental defectives varies greatly from those of mothers in the general population.

Figure 10 and Table V present the situation with regard to foreign-born mothers. The age groups —20, 20-24, and 25-29 years, show the same characteristic larger families than were observed in all age groups of native mothers. The older age groups from 30 years up show smaller families than our foreign groups. The totals are also smaller. Why the older foreign mothers of retardates or defectives should have smaller families than foreign mothers of the same age groups in the general population is not clear and offers a fertile field for further investigation. Some unknown factor is restricting the size of family of foreign-born mothers in the older age groups, which is not operating in foreign-born mothers under thirty nor in native mothers of all ages.

When we study the ages of the foreign-born mothers as seen in Figure 11 and Table VI, we see a result which has a definite bearing on the totals for all ages. The foreign mothers of our group are younger than the foreign mothers of New York. This results in an elevation of the totals of children born for all ages in the New York group. The larger numbers of older mothers having children will contribute larger families to the totals and thereby raise the means to a higher level. While we could not question the findings in reference to the comparison between the individual age groups, we were justified in scrutinizing our sources having a bearing on the totals. Has restricted immigration resulted in relatively fewer younger foreign mothers in New York? This restricting influence of immigration was not apparent when the children of our groups were born (approximately 1910 - 1917). While the number of children born to foreign mothers in New York State was 4.2, the average for the entire country for 1924 was 3.9. The average of 3.9 is higher than our figures of 3.8 and suggests that our finding, as recorded, is probably a fact. It is a fact, however, which had been exaggerated by the effect which restricted immigration has had on the age distribution of foreign-born mothers in New York State. We apparently have the fact before us that for some reason, at present unknown, the foreign mothers of retardates above the age of thirty are having smaller families than foreign mothers in the general population. Suggestions are only guesses, but we wonder if the foreign mothers of our group had their children more rapidly and at younger ages. This possibility suggests itself as it will be seen later that the completed families of foreign-born mothers of our groups are not smaller.

## Completed Families

The second method of investigating the size of families remains for discussion. That is, the method of taking the number of children born to women forty-five years or older. We have taken the mothers of our groups who were thirty-five years of age or over at the birth of the child and considered these families as completed. Insofar as the mean age of children examined was twelve years and the mothers were thirty-five years or more at the birth of these children, the present age of mother was forty-seven years or more. There is a slight error in considering families as completed who have a retardate or defective under nine years of age. These, however, are in the minority and the error is small.

To make a comparison between the number of children ever born to families producing normally intelligent children and the number ever born to families producing retarded children,

we will use two groups of families producing presumably gifted children:

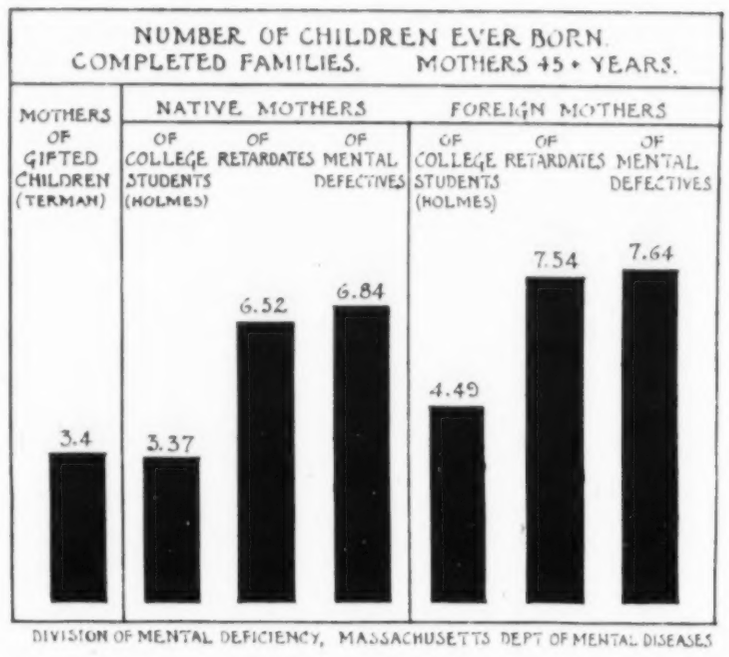
(1) Families with a gifted child (Intelligence quotient 1.40 +) reported by Terman.[3]

(2) Families of College Students reported by Holmes.[4]

This gives a contrast between the number of children being produced by families with a child in the upper levels of intelligence, and the number of children being produced by families with a child at the opposite end of the intelligence scale. Figure 12 and Table VII give us the figures. It is a striking illustration of the difference in the fecundity of mothers producing the more intelligent and mothers producing the less intelligent children. These figures have been corrected for sampling in Table VIII. This correction removes the error which is due to the inevitable selection of larger families, because of the fact that there is a greater opportunity for the larger families to have a child fall in any selected group simply by chance.

It is recognized that our figures are only rough aggregates and are no indication of the fecundity of the stocks from which these children are born. They represent only the children produced by the married portion of the social levels involved. This immediately suggests the question of a higher marriage rate among persons of this level as compared with other levels. Not all of these marriages result in children and again we wonder if the fecundity of our group is higher than that of the groups used for comparison. In correcting for childless marriages the 17 per cent deduction of Lotka[5] was used. The matter of celibacy in these groups is probably not of serious import.

It is also to be questioned whether or not the presence of the defective child is a determining factor in limiting the size of family. Unless the child be of extremely low-grade type the diagnosis is not made until he is in school and by that time several other children could




**SIZE OF COMPLETED FAMILIES**

**Figure 12**

In this group the families with a child in the lower levels of intelligence are approximately twice as large as completed families with a child in the upper levels of intelligence.

have been born. We can understand how the Mongolian, a definite pathologic entity, is the last born of the family. The family automatically stops at his birth. The lack of disturbance in the order of birth of our group makes us believe that voluntary discontinuance of the family is not a common occurrence.

In Table VIII we present the results of the above corrections compared with Terman's figures. From the corrected figures we see that each individual from the social stratum of our group is producing from 1.88 to 2.49 children as compared with .90 for Terman's figures. The individuals of the social level of our group are more than maintaining themselves, while the individuals from the other end of the scale are obviously not maintaining themselves.

## Summary

I. The foreign-born mothers (43 per cent of the population of the towns surveyed) are over-represented as mothers of our group. They make up 68 per cent of the mothers of retarded children and 75 per cent of the mothers of mentally defective children.

II. Native-born mothers of retardates and mental defectives in our group have larger families than native mothers of

the same age groups in New York State. This condition applies also to foreign-born mothers of retardates and mental defectives of the age groups —20, 20-24, and 25-29 years. Foreign-born mothers of the age groups 30 years and over show a tendency to have smaller families than foreign mothers of the same age in the general population.

III. The mean number of children ever born to completed families is recorded as follows by mental condition of child and nativity of mother:

| | | |
|---|---|---|
| Native-born mothers of retardates | (I.Q., .70+) | =6.52±.21 (S.D.). |
| Native-born mothers of mental defectives | (I.Q. —.70) | = 6.84±.23 (S.D.). |
| Foreign-born mothers of retardates | (I.Q., .70+) | =7.54±.11 (S.D.). |
| Foreign-born mothers of mental defectives | (I.Q. —.70) | = 7.64±.09 (S.D.). |

IV. In this sample completed families with a child in the lower levels of intelligence are approximately twice as large as completed families with a child in the upper levels of intelligence. The stocks represented in this sample which are producing retarded or mentally defective children are more than maintaining themselves.

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1. Dayton, N. A. Order of Birth. Survey of 10,455 Retarded Children in the Public Schools of Massachusetts. *Journal of Heredity*. 20:219-224.

2. Holmes, S. J. The Fertility of the Stocks Which Supply College Students. *Journal of Heredity*, 18:235-239. July, 1926.

3. Lotka, Alfred J. Sterility in American Marriages. *Proceedings of the National Academy of Sciences*, 14:99. January, 1928.

4. Terman, L. M. Mental and Physical Traits of a Thousand Gifted Children. Stanford University Press, California. 2nd Edition, 1926.

TABLE I -- Numbers of Retarded and Mentally Defective School Children by Sex

| | Retarded (I.Q. + .70) | Mentally Defective (I.Q. - .70) | Unknown | Total |
|---|---|---|---|---|
| Male | 3221 | 3450 | 23 | 6694 |
| Female | 1489 | 2250 | 22 | 3761 |
| Total | 4710 | 5700 | 45 | 10455 |

(Tables II-VIII on following pages)

TABLE II -- Nativity of Mothers of Retarded and Mentally Defective Children Compared with the Nativity of the White Female Population (ages 20-44) of the cities and towns surveyed.

| Nativity | White Female Population 1920. (Ages 20 - 44) | Mothers of Retarded Children | Mothers of Mentally Defective Children |
|---|---|---|---|
| Native | 136,450 | 1,363 | 1,301 |
| Foreign | 102,582 | 2,932 | 4,008 |
| Total | 239,032 | 4,295 | 5,309 |

TABLE III -- Number of Children Born to Native White Mothers by Age of Mother
(1) Births in New York State (1923, 1924, 1925)
(2) Retardates and Mental Defectives, by Age of Mother at Birth of Retardate or Mental Defective.

| | Age Groups | | | | | | |
|---|---|---|---|---|---|---|---|
| | -20 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | All Ages |
| Births | | | | | | | |
| In New York State | 1.2(21325) | 1.8(62487) | 2.6(61371) | 3.6(42575) | 4.8(23148) | 6.1(7023) | 2.8(218516) |
| To Mothers of Retardates | 1.2(140) | 2.0(375) | 3.0(343) | 4.2(222) | 5.3(140) | 6.4(46) | 3.2(1363) |
| To Mothers of Mental Defectives | 1.3(131) | 2.0(368) | 3.3(298) | 4.5(218) | 5.3(120) | 6.7(50) | 3.3(1301) |

TABLE IV -- Ages of Native Mothers
(1) In the Population of New York State (1923, 1924, 1925) Births)
(2) Mothers of Retarded Children
(3) Mothers of Mentally Defective Children

| | Age Groups | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | -20 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | 45-49 | 50+ | Unk. | Total |
| Mothers in N. Y. State | 21,325 | 62,487 | 61,371 | 42,575 | 23,148 | 7,023 | 507 | 13 | 67 | 218516 |
| Mothers of Retarded Children | 140 | 375 | 343 | 222 | 140 | 46 | 7 | 1 | 89 | 1363 |
| Mothers of Mentally Defective Children | 131 | 368 | 298 | 218 | 120 | 50 | 11 | 6 | 99 | 1301 |

| | MODE | MEDIAN | MEAN | S.D. |
|---|---|---|---|---|
| Mothers in New York State | 22.45 | 27.00 | 27.66 | ± .01 |
| Mothers of Retarded Children | 22.45 | 26.71 | 27.58 | ± .18 |
| Mothers of Mentally Defective Children | 22.45 | 26.66 | 27.72 | ± .[illegible] |

TABLE V -- Number of Children Born to Foreign White Mothers by Age of Mother
(1) All Births in New York State (1923, 1924, 1925)
(2) Retardates and Mental Defectives, by Age of Mother at Birth of Retardate or Mental Defective

| | Age Groups | | | | | | |
|---|---|---|---|---|---|---|---|
| | - 20 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | All Ages |
| Births | | | | | | | |
| In New York State | 1.2(3298) | 2.0(15563) | 3.2(22127) | 4.8(21210) | 6.4(15888) | 7.9(5284) | 4.2(83915) |
| To Mothers of Retardates | 1.3(150) | 2.2(694) | 3.2(764) | 4.5(566) | 6.1(421) | 7.5(118) | 3.8(2932) |
| To Mothers of Mental Defectives. | 1.5(246) | 2.2(937) | 3.4(983) | 4.7(748) | 6.1(526) | 7.2(213) | 3.8(4008) |

TABLE VI -- Ages of Foreign-Born Mothers
(1) In Population of New York State (1923, 1924, 1925 births)
(2) Mothers of Retarded Children
(3) Mothers of Mentally Defective Children

| | Age Groups | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | - 20 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | 45-49 | 50+ | Unk. | Total |
| Mothers in New York State | 3,298 | 15,563 | 22,127 | 21,210 | 15,888 | 5,284 | 514 | 12 | 19 | 83,915 |
| Mothers of Retarded Children | 150 | 694 | 764 | 566 | 421 | 118 | 27 | 4 | 188 | 2,932 |
| Mothers of Mentally Defective Children | 246 | 937 | 983 | 748 | 526 | 213 | 42 | 8 | 305 | 4,008 |

| | MODE | MEDIAN | MEAN | S. D. |
|---|---|---|---|---|
| Mothers in New York State | 27.45 | 30.19 | 30.38 | ± .02 |
| Mothers of Retarded Children | 27.45 | 28.38 | 29.11 | ± .12 |
| Mothers of Mentally Defective Children | 27.45 | 28.33 | 29.13 | ± .11 |

TABLE VII -- Number of Children Ever Born, Completed Families -- Mothers 45 Years and over

To Mothers of Gifted Children (Terman)[2]

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Total | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | 22 | 16 | 11 | 7 | 7 | 3 | 2 | 2 | 0 | 2 | 91 | 3.4 |

To Mothers of College Students (Holmes)[3]

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Total | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Native | 426 | 792 | 682 | 451 | 282 | 186 | 100 | 56 | 41 | 17 | 7 | 7 | 2 | 2 | 3051 | 3.37 |
| Foreign | 54 | 112 | 145 | 108 | 101 | 81 | 56 | 33 | 21 | 17 | 10 | 2 | 4 | 1 | 745 | 4.49 |

To Mothers of Retarded Children

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10+ | Unk. | Total | Mean | S.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Native | 6 | 20 | 11 | 14 | 23 | 28 | 17 | 20 | 14 | 39 | 2 | 194 | 6.52 | ± .2 |
| Foreign | 10 | 17 | 24 | 43 | 64 | 54 | 51 | 81 | 61 | 164 | 2 | 571 | 7.54 | ± .1 |

To Mothers of Mentally Defective Children

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10+ | Unk. | Total | Mean | S.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Native | 8 | 14 | 15 | 12 | 19 | 20 | 20 | 14 | 16 | 49 | 0 | 187 | 6.84 | ± .2 |
| Foreign | 12 | 20 | 30 | 55 | 73 | 81 | 90 | 108 | 89 | 225 | 7 | 790 | 7.64 | ± .0 |

TABLE VIII -- Number of Children Ever Born to Mothers of Gifted Children and of Backward Children: Completed Families

| | Uncorrected Mean | Corrected for Sampling | Corrected for Childless Marriages |
|---|---|---|---|
| Gifted Children(TERMAN) | 3.40 | 2.18 | 1.80 |
| Retarded Children (Native Mothers) | 6.52 | 4.52 | 3.76 |
| Mentally Defective Children (Native Mothers) | 6.84 | 4.56 | 3.79 |
| Retarded Children (Foreign Mothers) | 7.54 | 5.79 | 4.81 |
| Mentally Defective Children (Foreign Mothers) | 7.64 | 5.99 | 4.98 |

## Books Received

*BOOKS are acknowledged in this column as received, and such acknowledgment must be regarded as sufficient return for the courtesy of the sender. As far as space permits, books that contain material of special interest to the readers of the* JOURNAL *will be reviewed in later numbers.*

THE CHILD'S HEREDITY, *by* PAUL POPENOE. Pp. 316. 28 Chapters; 26 illustrations. Price, $2.00. The Williams & Wilkins Co., Baltimore, 1929.

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HEREDITY AND PARENTHOOD, *by* SAMUEL C. SCHMUCKER, Ph.D., Sc.D., Emeritus Professor of Biological Sciences, State Teachers' College, West Chester, Pa. Pp. 322. 2 Parts; 23 Chapters; 43 Illustrations. Price, $2.50. Macmillan Company, New York, 1929.

If any parent remains ignorant of heredity it will not be due to lack of attempts (many excellent) to inform them on the subject.

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ACTA UNIVERSITATIS VORONEGIENSIS. Tomus IV. Pp. 769. 4 Parts; 25 Chapters. Illustrated. Woronesh, U. S. S. R., 1927.

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RECHERCHES SUR LA SEXUALITE DES CHAMPIGNONS. Le Probleme de la biochimie comparee du sexe: *by* WILLIAM H. SCHOPFER, Sc.D. Pp. 172. 11 Plates; 25 Figures; 12 Tables. Extract from the bulletin of the Botanical Society of Geneva, 1928.

Sex in fungi, and the comparative biochemistry of sex. Eleven excellent plates and an extensive bibliography.

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DAS VERHALTEN DER CHROMOSOME BEI DER SPERMATOGENESE VON ORGYIA THYELLINA BTL. UND ANTIQUA L., sowie eines ihrer Bastarde, *by* MAX CRETSCHMAR. Pp. 108, 8 Plates. Verlagsbuchhandlung Julius Springer, Berlin, 1928.

Cytology of two species of moths and their hybrids. Excellent plates from drawings and microphotographs.

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TWENTY-FIVE YEARS OF AMERICAN MEDICAL ACTIVITY ON THE ISTHMUS OF PANAMA, 1904-1929; "A Triumph of Preventive Medicine." *By* WESTON P. CHAMBERLIN, Colonel, Medical Corps, U. S. Army, Chief Health Officer, The Panama Canal. Pp. 74. 6 Chapters, 23 Plates, 2 Maps. The Panama Canal Press, Mount Hope, C. Z., 1929.

History of one of the most successful attempts to make the Tropics safe for the white race.

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HEREDITY AND HUMAN PROBLEMS: A Series of Eight Radio Talks (With Select Bibliography). *By* P. W. WHITING, Ph. D., Associate Professor of Zoology, University of Pittsburgh. Broadcast from the University of Pittsburgh Studio of KDKA, Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa. Pp. 87. Price, Sixty Cents. Radio Publication No. 50, University of Pittsburgh, Pittsburgh, 1929.

Heredity becoming ether-minded—and quite successfully!

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RADIO IN EDUCATION: The Ohio School of the Air and Other Experiments. *By* ARMSTRONG PERRY, Radio Counsel, The Payne Fund, One Madison Avenue, New York. Pp. 130. The Junior Extension University Press, New York, 1929.

Education follows suit.

# PRECOCIOUS LILAC HYBRIDS

F. L. Skinner,

*Dropmore, Canada*

**A YEAR-OLD HYBRID**

**Figure 13**

A hybrid of the Korean and the common lilac well set with flower buds in the summer of 1928, from seed germinated April to September, 1927. Such hybrids often produce flowers the second year and so far have proved fairly hardy in Manitoba.

WHILE on a visit to the Arnold Arboretum in the autumn of 1918, I secured a few seedlings, one to two inches high, of *Syringa dilitata* and *S. velutina* which had been grown from seed collected by Mr. E. H. Wilson in Korea during the previous summer. These have done well at Dropmore and so far have shown no signs of winter injury though on two occasions during the past ten years many forms of *Syringa vulgaris*

**A FOUR-YEAR-OLD HYBRID LILAC**

**Figure 14**

Produced by crossing the common lilac (*S. vulgaris*) with the Korean species *S. dilitata*. The hybrids are rapid-growing but apparently hardiness is recessive, as the hybrids are not as cold-resistent as the Korean species. In later generations of the cross it might be possible to combine this lost hardiness with the desirable earliness that charaterizes this cross.

have been more or less injured by our winters. With a view of increasing the hardiness of the common Lilac I crossed several varieties with *S. dilitata* in 1921 and many of the resulting seedlings flowered in 1924 when just three years old and the accompanying picture shows one of these hybrids when four years old. (Figure 14).

Apparently hardiness is a recessive quality in this cross, as quite a number of the hybrids suffered during the winter of 1927-28; this was rather a severe winter on *S. vulgaris* and most varieties were injured so badly that only a very few flowers were produced. These hybrids showed a remarkable precocity in flowering, however, as it is seldom that seedlings of *S. vulgaris* flower, with us, until seven or eight years of age.

Another batch of hybrids raised from *S. vulgaris* to the pollen of *S. velutina* have shown an even more remarkable example of precocity. These germinated in April, 1927, were transferred to the open ground in June, 1927, and in September, 1928, the seedlings were from 24 to 30 inches high and when examined at that time by Mr. K. A. Ryerson of the Bureau of Plant Industry at Washington, D. C., and myself, many of them were found to have flower buds not only in the terminal buds but in many of the axilary buds as well.

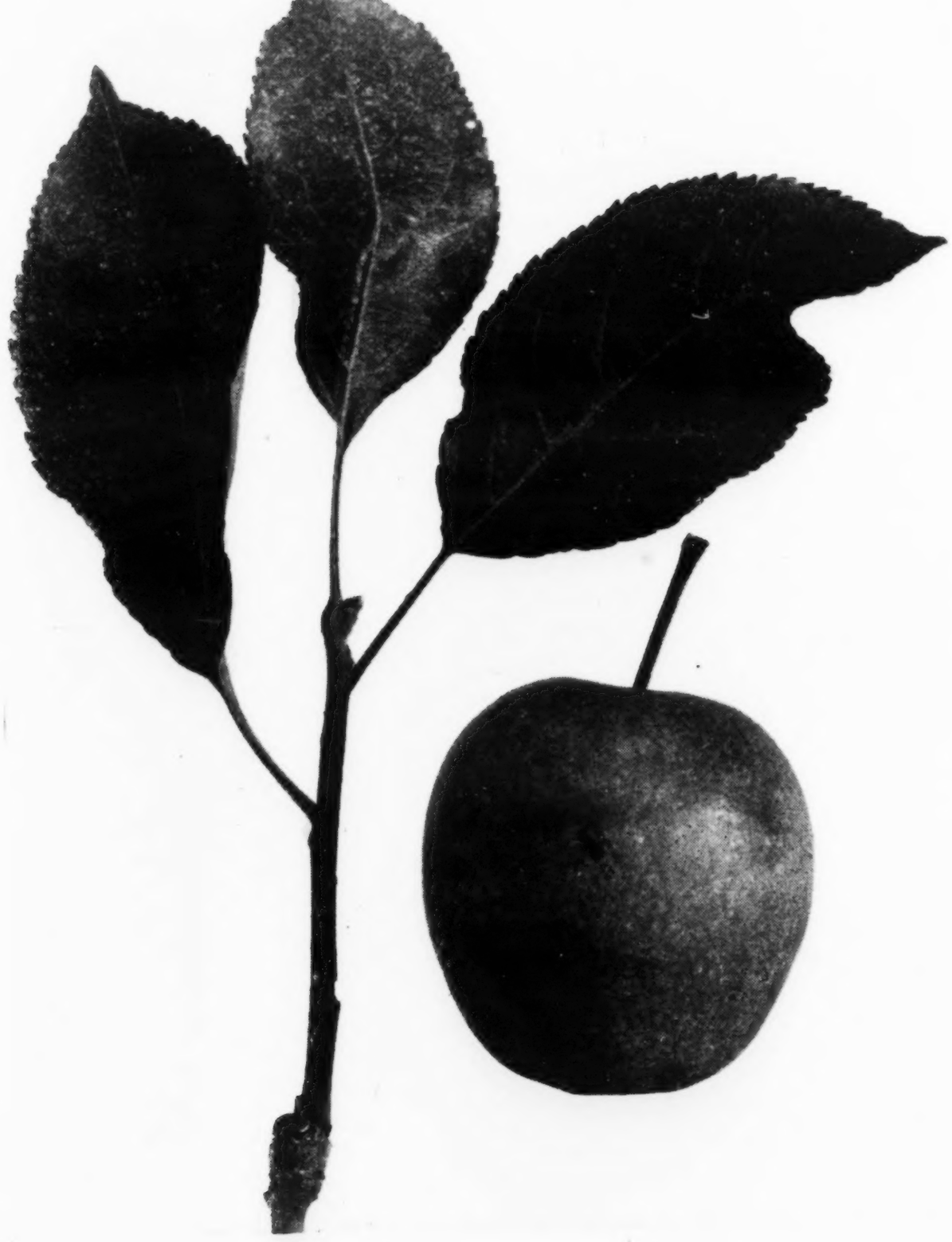
This example of precocity in hybrids of *S. vulgaris* is all the more remarkable when one considers the effect of hybridization on another species which usually flowers very early from seed. At the same time that the *vulgaris* × *velutina* seeds were germinated we also raised a batch of *S. villosa* × *S. formosissima;* these were transferred to the same part of the garden as the former lot and on the same day. The difference in growth is, however, very striking, the tallest *villosa* × *formosissima* being about twelve inches high and having only one stem, while the *vulgaris* hybrids are nice, compact bushes of four to six stems. Seedlings of *S. villosa* germinated in the open ground in 1928 run from four to ten inches high and a few bushes of this species produced flowers in June, 1928, when 24 months old.

Apparently, therefore, hybridization may be expected to produce a race of *S. vulgaris* hybrids which will flower at an early age, while the early flowering habit of *S. villosa* is likely to be lost when it is crossed with other species.

**THE OREGON CRAB-APPLE**

**Figure 15**

Fruit, leaves and twig of *P. fusca*, the "Oregon Crab-apple."



**A HYBRID WITH THE CULTIVATED APPLE**

**Figure 16**

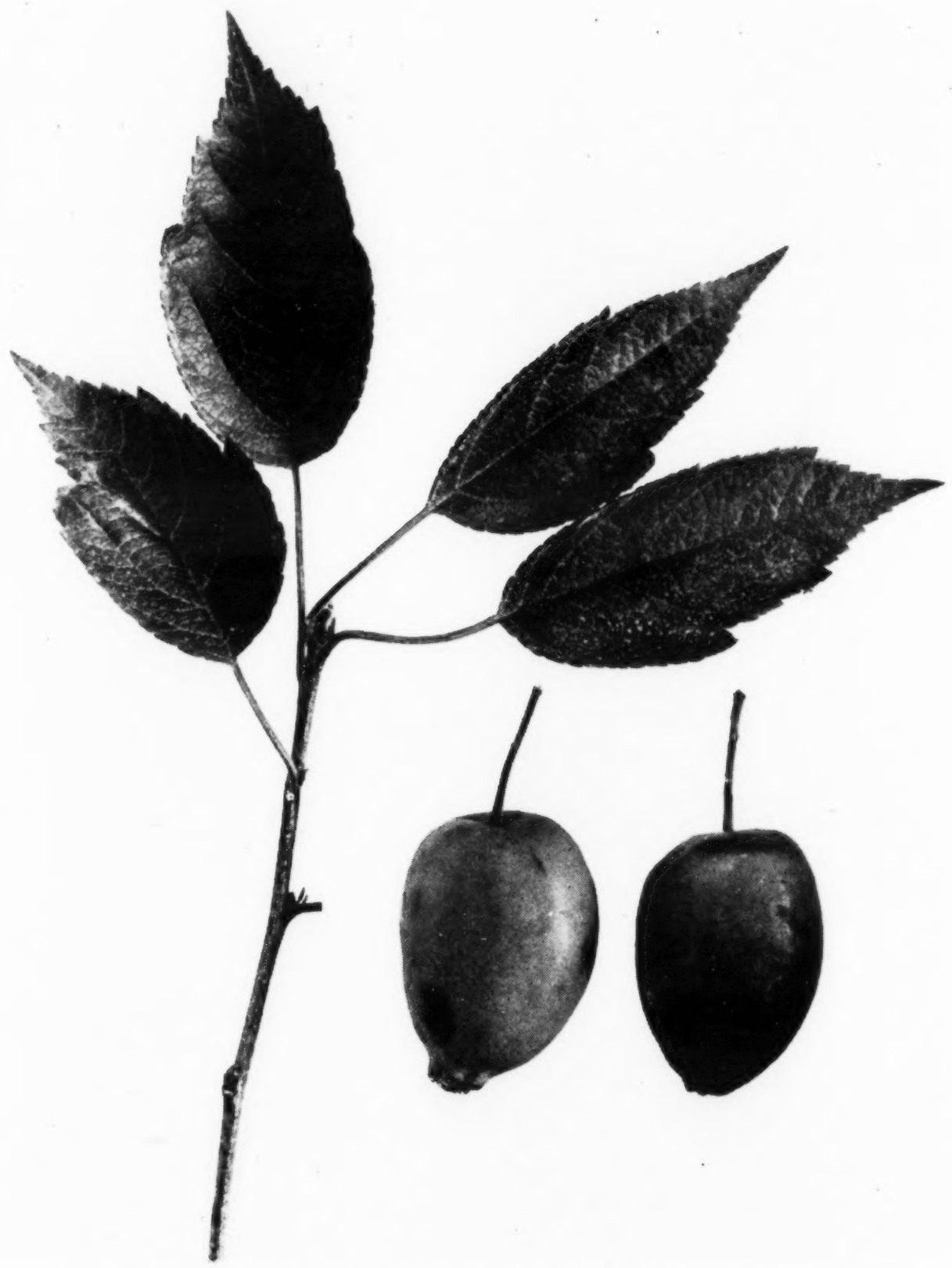
A hybrid of the Oregon crabapple with the Yellow Newton, a cultivated variety of *P. malus*. The hybrids appear promising as a source of new varieties of crabapples, as the fruit makes excellent jelly.

# HYBRIDS BETWEEN PYRUS MALUS AND PYRUS FUSCA

HENRY HARTMAN, *Oregon Experiment Station*

IT is generally known that *P. malus*, the common apple of cultivation, hybridizes freely with certain wild apple species. It appears, in fact, that most of the crabapples of American pomology are the results of such crosses. Varieties such as Fluke and Mathews, apparently, are hybrids of *P. malus* and *P. ioensis*,[2] while the large forms of Siberian crabapples such as Hyslop, Transcendent, and Martha, undoubtedly are crosses of *P. malus*, and *P. baccata*.[3]

While considerable attention has been given to some of the hybrid forms of Malus, horticultural and botanical literature gives but little recognition to the crosses of *P. malus*, and *P. fusca*, the "Oregon Crabapple." It is suggested by Sargent[1] that *P. dawsoniana*, Rehd. is probably a hybrid of these two species, but, aside from this, the subject is hardly mentioned. The present paper calls attention to these hybrids as they have appeared in the wild and in cultivation.



**NATURAL HYBRIDS ARE FOUND IN THE WILD**

**Figure 17**

Fruit and leaves of a natural hybrid of *P. fusca* and *P. malus*. Some of the trees have attained a considerable size, which is not surprising when it is considered that the apple was introduced into western Oregon over a century ago.

The Oregon crabapple is known by various scientific and common names. It is the *P. fusca* of Rafinesque, the *P. rivularis* of Douglass, and the *Malus rivularis* of Roemer. In common language, it is referred to as "Oregon Crabapple" or "Creek Pyrus".

The species is indigenous to the region west of the Cascade mountains in Oregon, Washington and British Columbia. It is usually found growing in deep, rich soil in the neighborhood

of streams, often forming thickets of considerable extent. It is usually a shrub or a small tree, occasionally attaining a height of 30-40 feet. Its young growth is usually pubescent, while its leaves are "ovate—lanceolate, acute, or accuminate, very sharply and strongly serrate, often 3-lobed or notched on the strong shoots, and pubescent beneath". Its flowers are white, usually appearing when the leaves are nearly or quite full grown. Its fruit (Figure 15) is decidedly acid and astringent to the taste, oblong in form (¾ inch or less in length) yellow or greenish in color, with deciduous calyx lobes.

The species in its pure form is not fully hardy to cold. The low temperatures of 1919 and 1924 in Oregon did considerable damage even to large, mature trees growing in the wild.

A number of years ago the Oregon Experiment Station made several crosses of *P. fusca* with some of the cultivated varieties of apples.* Several of these $F_1$ generation hybrids have been bearing for some time, and observations of the trees and fruit have been made.

Although a considerable amount of variation is manifested by these hybrids, they are distinctive in many ways and constitute a fairly definite type. The trees for the most part are vigorous with slender but strong resilient branches. Their foliage is usually luxuriant, the leaves being large and numerous. The fruit combines the characteristics of both parents. In size it compares favorably with that of the largest forms of crabapples. It is decidedly oblong in form. Its calyx lobes are either deciduous or persistant upon the mature fruit. In color the fruit ranges from green to yellow, occasionally displaying a blush. The red color, however, is never as pronounced as that found in the hybrids of *P. baccata.*

The fruit is high in acid and astringency compounds. It is very firm in texture, juicy and relatively fine grained. It is excellent for pickling, jelly-making and other culinary uses.

What appear to be natural hybrids of *P. malus* and *P. fusca* are occasionally found west of the Cascade mountains. Some of these trees are large and appear to be quite old. This fact is entirely possible since the common apple was introduced into this region as early as 1825 and since it was fairly well disseminated by 1850.

Owing to the limited demand for the fruit, there is no great incentive at the present time to develop new varities of crabapples. If the occasion should arise, however, when crabapples are again in favor, the hybrids of *P. fusca* undoubtedly offer some promise. At any rate, they are of interest to the geneticists since they add another group to the list of plants resulting from the crossing of exotic and native American species.

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1. Bailey, L. H. Pyrus. *Stand. Clc. of Hort.,* V:2865,2878.

2. Craig, J. and Hume, H. H. Native Crabapples and their Cultivated Varieties. *Iowa Acad. Sci.,* VII:123-141.

3. Beach, S. A. The Apples of New York. *Rep. N. Y. Ag. Exp. Sta.,* 1903, 1:1-409.

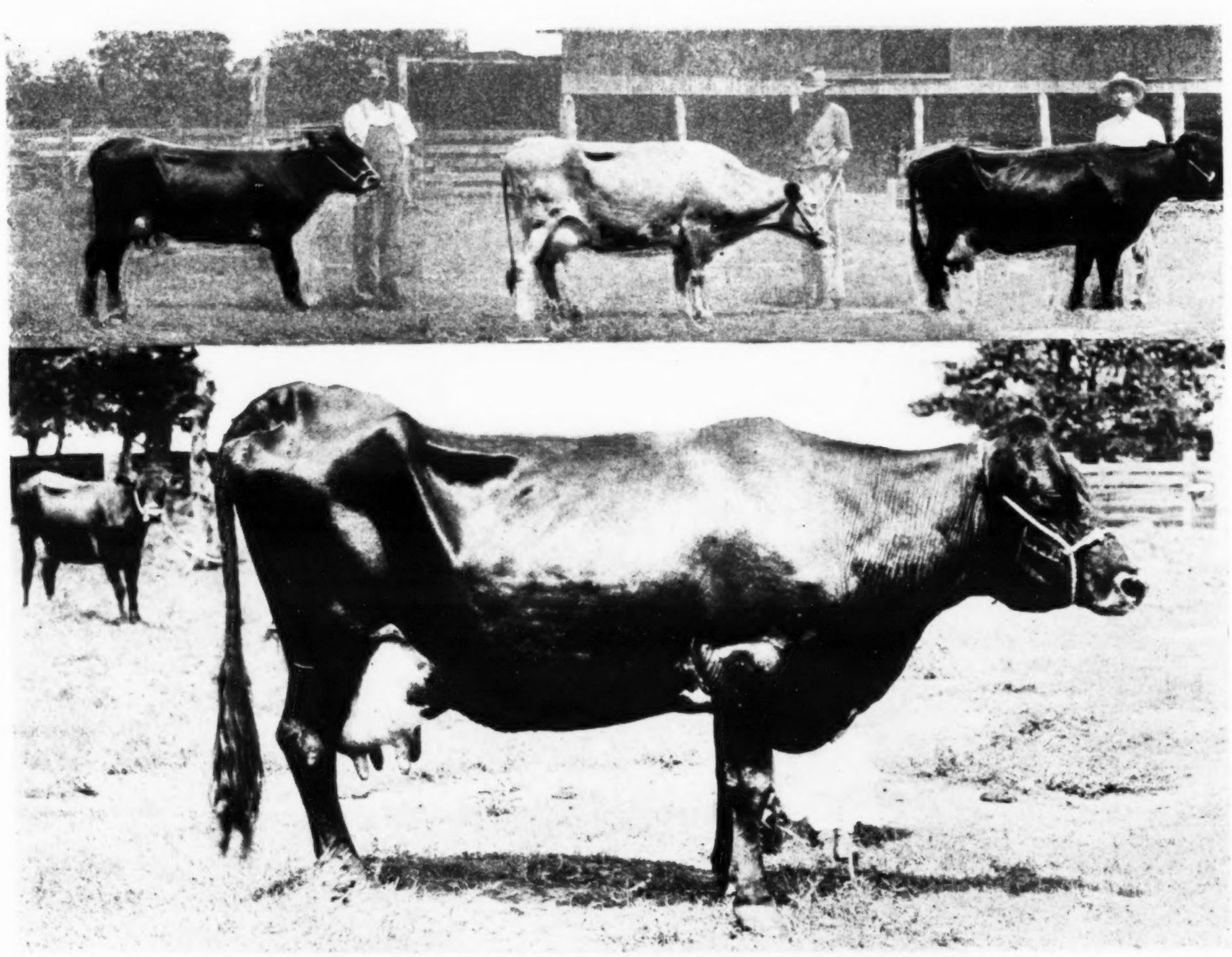
*Some of these crosses were made by Professor V. R. Gardner.

# ATAVISM IN JERSEY CATTLE

## An Impressive Case of Reversion in Color Inheritance

JAY L. LUSH

*Texas Agricultural Experiment Station*



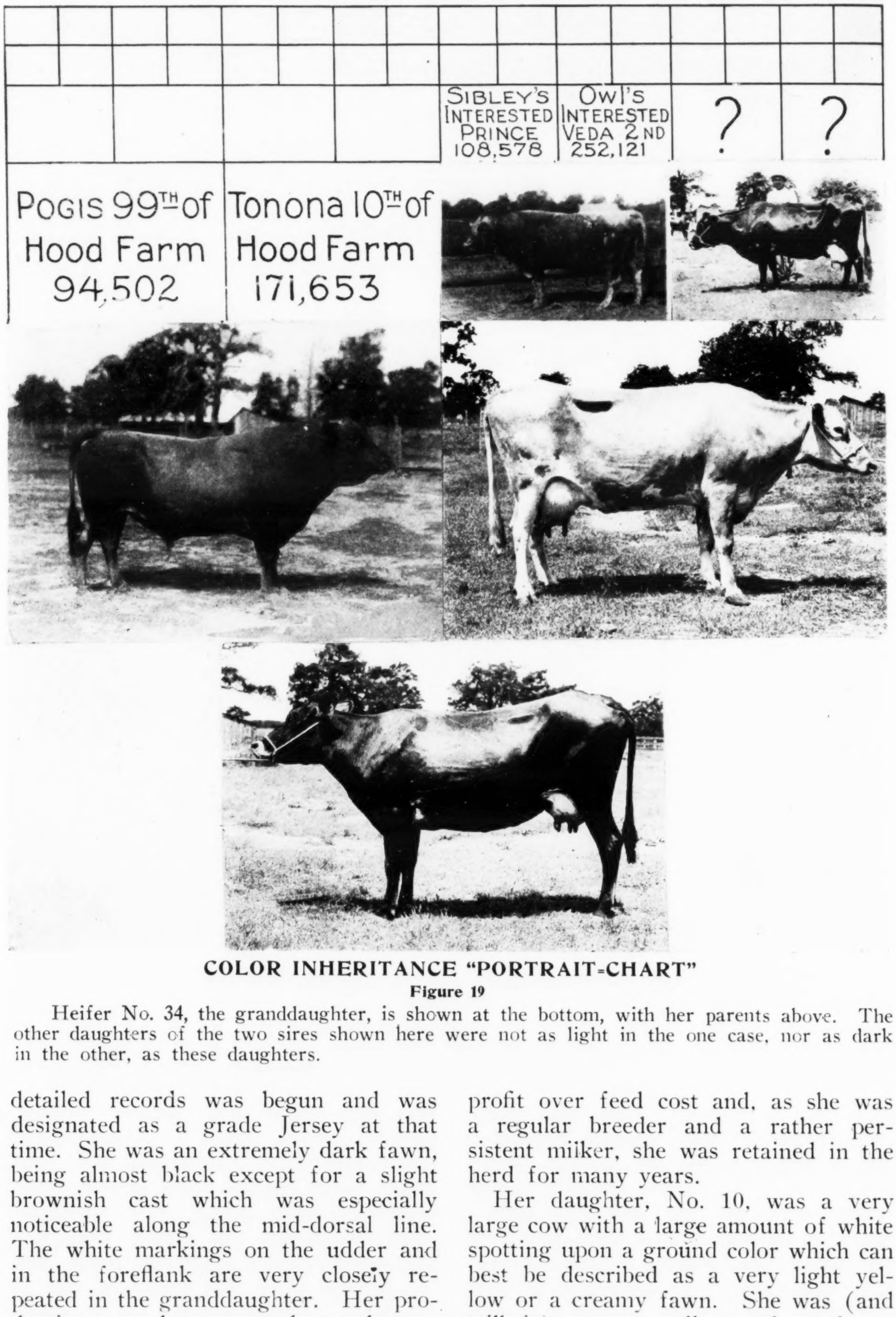
**THREE GENERATIONS—DARK—LIGHT—DARK**

**Figure 18**

The upper view shows, from left to right: daughter, dam, granddam. Below is shown a closer view of the granddam. The two dark cows are darker than the average Jersey—the intermediate "generation" is the lightest cow in the herd.

IN the Jersey herd of the Texas Agricultural Experiment Station the darkest-colored foundation cow is the dam of the lightest-colored heifer raised in the eleven years during which careful records have been kept. And yet that light-colored heifer is herself the mother of the darkest-colored heifer calf raised during that period. This pronounced resemblance of granddam and granddaughter both quite unlike the intermediate relative (so far as color goes) is indicated in the accompanying pictures. Figure 18 shows the three cows tandem, the foundation cow in front and the granddaughter in the rear and below a close-up of the old foundation cow, No. 47. Figure 19 shows a genealogical portrait chart of the granddaughter according to the scheme suggested by David Fairchild.* Nothing is known about 47's ancestors. She was already in the herd when the keeping of systematic

*FAIRCHILD, DAVID. 1921. A Genetic Portrait Chart. *Journal of Heredity* 12:213-219.




**COLOR INHERITANCE "PORTRAIT=CHART"**

**Figure 19**

Heifer No. 34, the granddaughter, is shown at the bottom, with her parents above. The other daughters of the two sires shown here were not as light in the one case, nor as dark in the other, as these daughters.

detailed records was begun and was designated as a grade Jersey at that time. She was an extremely dark fawn, being almost black except for a slight brownish cast which was especially noticeable along the mid-dorsal line. The white markings on the udder and in the foreflank are very closely repeated in the granddaughter. Her production was large enough to show a profit over feed cost and, as she was a regular breeder and a rather persistent milker, she was retained in the herd for many years.

Her daughter, No. 10, was a very large cow with a large amount of white spotting upon a ground color which can best be described as a very light yellow or a creamy fawn. She was (and still is) an unusually good producer.

No. 10's sire was rather lighter than the usual Jersey, being best described as a golden or reddish fawn.

No. 34, the granddaughter in the case, resembled her granddam more than her dam in size and in certain conspicuous features such as shape and slope of rump and tailhead as well as in color. There was just a shade more of brown in her almost black body color. However, she resembled her dam more than her granddam in production. The sire of No. 34 was somewhat darker than the average Jersey bull, but (lest it be thought that the sires of 34 and 10 were entirely responsible for the colors of those cows) she was the darkest of his daughters, whereas No. 10 was the lightest among her sire's daughters.

It is, of course, unlikely that any new principles of genetics are involved in this case. It is, however, an unusually clear-cut case of the familiar phenomenon of atavism or reversion. It also points to the usefulness of pedigree study in cases where a rather complete progeny test of an animal's genotype is not available. Had we known nothing about 10's dam we would have been totally unprepared for the production by her of such a daughter as 34. But, knowing her dam, we had every right to expect 10 to produce some dark offspring, although we did not, of course, expect one which would be quite as near a repetition of 47 as 34 actually turned out ot be. No. 47 had two other daughters of which one (a full sister to No. 10) was a golden reddish fawn and the other (by a different sire) was a medium dark fawn with more white spotting than No. 47 but less than No. 10. Neither 47 nor 10 had other heifer calves and the bull calves were not saved.

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# STONE AGES IN EUROPE

THE prehistoric background of human existence in Europe is being extended by archaeology and geology to a remote past, through hundreds of thousands or millions of years. The Neolithic period, since the arts of civilization began to be introduced, has been very short, perhaps only 7000 or 8000 years, but the Palaeolithic ages already had lasted ten or twenty times as long. From 300,000 to 500,000 years are considered as low estimates.

Remains of the early Stone Age peoples have been found in hundreds of localities scattered through many European countries, not representing a single race, but showing widely different varieties or species of mankind, distinguished not only by their bones and their burial customs, but by many differences in materials and methods used in working flints or other kinds of stone into tools, weapons and missiles. Some of these artifacts are highly specialized and form very distinct series, so that successions of different peoples are shown in the same localities, and connected with erosions and deposits that leave no doubt of a lapse of time sufficient for profound geologic, geographic and biologic changes. At least three extensive periods of glacial devastation are established with many milleniums of genial conditions between, affording new successions of plants, animals and people. The same races did not come back, but others came in, no doubt from outlying regions not depopulated by the cold.

The skulls and skeletons of the different kinds of people have now been associated in many cases with remains of the animals that they hunted, which include many species now extinct. Some of the prehistoric hunters left striking evidences of artistic talent as shown in clay models, bone carvings and cave paintings, including unmistakable representations of some of the extinct animals. The early artists were cave dwellers and some of their work

is preserved in perfect condition in caves that were closed by rock-falls thousands of years ago, before even the first stages of agricultural civilization appeared.

Such facts have been familiar to ethnologists for several decades, but are yet to be assimilated by the general scientific public, partly because the volume of rapidly increasing information in this field has been so great as to be confusing, and partly for lack of a definite sequence and perspective of the numerous races, periods, horizons and "cultures" have been reported and described. But now attempts are being made to select and summarize the contrasting features of the successive prehistoric periods. "The Stone Age" by E. O. James, Exeter College, Oxford, presents a careful survey of existing knowledge of the prehistoric periods in language as little technical as possible*, so that the general reader can gain an idea of the remarkble results that have been reached in this field of inquiry regarding primitive man.

The custom of archaeologists has been to name the different prehistoric peoples from the localities where the first skulls or other typical relics were found, and all of the principal localities have been visited by this author, so that first-hand comparisons are made, instead of the usual compiled statements.

**Civilization Introduced Into Europe**

Chapters on "The Coming of the Cultivators" and "The Beginnings of Civilization" relate to the "Neolithic" period, and at some points may convey a misleading impression, as though very rapid progress had been made in a very short period, although it is clearly recognized that the Neolithic people who brought agriculture and the arts of a developing civilization into Europe were not "natives", but "invaders." Also it is plain that they were a maritime people, since they established themselves first on the coasts, from which the new arts were extended gradually and often in modified form to interior localities. This is a fact of obvious significance in the search for the origin of civilization. No truly indigenous development of agriculture or of other arts that have contributed to the growth of civilization is indicated for Europe or the adjacent Mediterranean regions. The long succession of Palaeolithic periods was brought definitely to an end by the coming of another race much farther advanced, and readily distinguished by many arts that previously had not been represented in the European area.

The prehistoric periods are of great interest and significance from the standpoint of human development, and in relation to the origins of European races, some of which may be traced back to the Palaeolithic ages. The physical characteristics and cranial capacity of some of the Palaeolithic people would indicate superior ability, but nothing apparently has been found to indicate that any progress was made in the direction of agriculture till the "invaders" came and brought a series of new arts of which no intimation had been afforded in the remains of the previous ages:

> The New Age.—With the establishment of the Neolithic invaders all this was completely changed, and new ideas were manifest wherever the new races penetrated. In the west, however, the process was more gradual than in the east and south, possibly because there a communication of ideas rather than a migration of peoples is reflected in the cultural advances, except along the coastlands. Be this as it may, the advent of new knowledge produced a marked advance on the former achievements all over the continent. The most notable innovations were the practice of agriculture, the domestication of animals, pottery-making, the use of polished and ground-stone implements (Fig. XXIX), and, closely associated with these customs, stone tombs and graves under earth mounds appeared, together with settlements containing groups of dwellings, earthworks, navigation, mining, textile manufacture, the use of the wheel, and other arts and crafts. But in this chapter we shall confine our attention to the two fundamental discoveries [domestication of animals and cultivation of

*James, O. E. The Stone Age. Pp. ..... Price, ..... The Sheldon Press, London, 1927.

crops] on which as it seems to us the new civilization was based . . . . the invention of agriculture being virtually the beginning of civilization since it produced a settled state of society and the assurance of a food supply. . . . . (Pp. 159-61-63.)

Where the Neolithic invaders came from or where the arts of civilization were developed that they brought to Europe is not indicated. It may be inferred that the homeland of the advanced Neolithics was in a remote region, since a more gradual spread of their arts into Europe would be expected from any contiguous area.

Localization of special arts would be expected in primitive times, the extension of any art depending upon the growth of the group that developed it, rather than upon borrowing from group to group. The more primitive a people the more violent the prejudice against anything foreign or "outlandish." Forced contacts by superior races result eventually in adoptions, but voluntary approval and ready acceptance of anything new or strange is an ability that only a few of the most advanced peoples have attained. This instinctive conservatism of primitive peoples forbids the assumptions of ready and rapid advance in the arts of civilization. On the contrary many of the more specialized arts that developed in the primitive ages did not become general, but decayed and disappeared. Abortive evolutions took place in the prehistoric ages, as well as in the subsequent periods of primitive civilization. The art of pottery-making for example seems to have been more highly developed in the early neolithic period than later. An art may be adopted temporarily by a people without the ability to maintain it, or an invading race may lose its special abilities by becoming incorporated with a native population. —O. F. COOK.

---

## Controlling Blooming by Length of Day

The following announcement by the U. S. Department of Agriculture reports effect of length of day in controlling time of flowering of chrysanthemums. In hybridizing plants this procedure should often prove useful. Unfortunately each species seems to have its own reaction, which makes experience with chrysanthemums inapplicable to other species. The growing literature on this subject gives the plant hybridizer an idea of the kind of reactions that may be expected.

Chrysanthemums blossoming in July instead of in October—one of the oddities produced last year by scientists studying the effect of daylight exposures on plants at the United States Department of Agriculture testing plots. Not only off-season flowering—but also the flowering of a part of the plant on July 15 and the remainder blooming 3 months and 3 days later.

"Many of the finer late varieties of Chrysanthemums appear to await the autumn days to flower. Do they really await timely conditions of coolness, as some have surmized, or does some other factor harmonize their flowering with the waning days of autumn?" asks Dr. H. A. Allard in the current issue of the department's yearbook.

"The plants themselves shall answer," he says. "Unquestionably, many plants have definite temperature requirements to thrive with foliage and flowers. The chrysanthemum, however, is not awaiting cooler temperatures, as it would seem, but shortening days. In experiments by the Bureau of Plant Industry, cuttings of a late variety, made in winter were grown to bushy plants by May. Then, these were exposed to only 10 hours of daylight, from 5.30 a. m. to 3.30 p. m., when they were moved to a darkened house. Plants so treated have flowered as early as July 15 or early August. Check plants did not flower until the middle of October."

In other tests the experimenters shaded only a part of the plant, leaving a part for full sun-lighting. The shaded shoots flowered early, the unshaded at the normal season. "It is evident," says Doctor Allard, "that the chrysanthemum flowers because the autumnal days initiate flowering, not because they are cool, but because of the short daylight exposure." These tests would appear to have certain practical interest to growers. For the breeder who desires to synchronize the flowering of very early and very late sorts for crossing, this behavior offers helpful suggestions.

**TWO HOLES, BUT ONLY ONE KERNEL**

**Figure 20**

The progressive Canadian red squirrel has adopted a new food, the peach-pit. Trained on the butternut to open both sides for the two halves of the kernel, he cannot learn the futility of gnawing a second hole in the peach-pit. The second hole is very small, for he desists as soon as he discovers his mistake. Whether generations of acquaintance with the peach-pit will produce acquired wisdom in this matter remains to be seen.

# SQUIRREL OR PEACH-PIT--"WHO'S THE NUT?"

## Illustrating How Difficult It Is to Get an Education in Canada

IN August, 1926, returning to camp from the postoffice at Bedford Mills, Ontario, two of us stopped for a moment to inspect floor timbering of a house that had been dismantled in the small hamlet. The houses had been built some forty years earlier during lumbering activities in that region; and this particular house had not been occupied for the previous year or two. It was being torn down for the sake of the lumber. Nothing remained but the varying timbering of the foundation, hewn, sawn and spiked timbers. This, we stopped to inspect. The house had been set upon open foundations of rock, and the house was near the water, and within easy reach of the mills and barns and the wild.

Upon the sill at two points near the front of the house, in planer-shavings that evidently originally constituted the "fill" of these houses, between sheathing and inside lathing, were quantities of empty peach pits; each with a quarter-inch opening upon the one face, and a pin-head opening upon the other (Figure 20). We brought away a handfull of them as curiosities. We exhibited them, jokingly, to the occasional science friend at home, using the phrase cited above about education. But our friends failed of seeing the point of the query, knowing neither nuts nor rodents.

The nuts of that section are beech, hazel, acorn and butternut; rarely an occasional planted black walnut. The usual rodents are present: particularly the ground, red, and black squirrels (the grey is rare).

The ground squirrel there is a native of the woods and open spaces and is common enough. The red squirrel is of occasional frequency only, and is there as elsewhere a pest, when infesting houses, barns and granaries. The black squirrel is not infrequent, but is wild, and ranges the oak plantations. Rats and mice are common. With the pits were no rat nor mice signs.

Peaches are brought into the community either from New York State or from Western Ontario. These pits are not familiar to us in form in New York. In a community such as Bedford Mills, where only a few summer apples live, and fall and winter fruits die from frost, or the fruits pretty regularly fail; where corn means only ensilage, for maize and wheat seldom mature; where the crops are hay, oats, barley, peas and potatoes; in such a habitat the red squirrel is surely feased when he stores for his winter food the pits of the peach. Trained upon the butternut, with its two leaves of the contained fruit, he must have curious dreams after laboriously cutting the second side of the peach, to find through the small pin-head opening only an empty delusion, and no repast after hard labor.

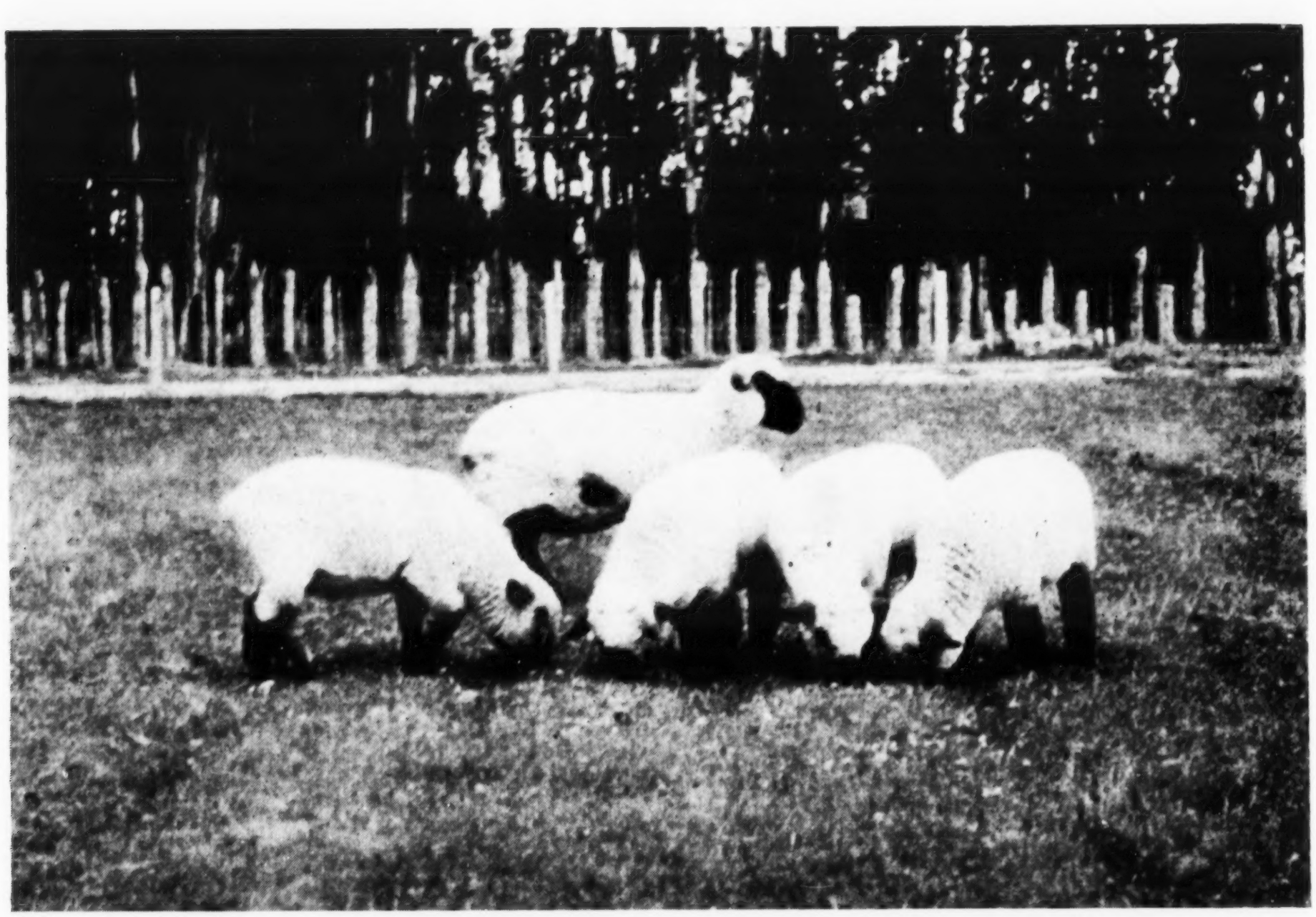
"How hard it is in Canada, etc"—and yet the Canadian red is a pioneer in peaches. For not yet has it been noted in New York that he has collected the peach pit. In nurseries here (Newark, N. Y.) where the pits are layered down in sand for the production of seedlings, for the later budding for nursery stocks, such peach layers are never disturbed.

Again, what may be the effect of the foreign hydrocyanic acid upon the native squirrel! Will he in due time, provided he survives his first acquaintance with the peach, acquire not only the taste for it but also the sense of but one opening needed to the nut?

*Ithaca, N. Y.* LUZERNE COVILLE.

# QUADRUPLET LAMBS

## Of a Purebred Hampshire Ewe



**QUADRUPLETS—AND PARENTS OF TWINS AND TRIPLETS**

**Figure 21**

IN Vol. XIX, No. 9, this journal, the author reported quintuplet lambs produced by a Rambouillet-Cotswold crossbred ewe. The accompanying picture is of a purebred Hampshire ewe and her quadruplet family, the property of L. L. Breckenridge, Twin Falls, Idaho. The lambs were dropped February 11, 1925. At the age of 90 days their average weight was 81 pounds, two having been reared by the ewe and two by the use of cows' milk fed in a pan. In 1926 the ewe produced a single and in 1927 a pair of lambs. Two of the quadruplets were kept in the flock, one producing twins and the other producing twins as well as a family of triplets.

J. E. NORDBY.

*University of Idaho,*
*Moscow, Idaho.*

# THE CARNATION ROSE

## An Unusual Teratologic Variation

J. H. Nicolas

*Research Department of the Conard-Pyle Co., West Grove, Pa.*

IT is a well-known fact that the wine from the western region of France (Province of Anjou) is identified by and sought for its aroma ("Bouquet") of strawberry. The natives attribute it to the century-old custom of cultivating strawberries between the rows of vines, claiming that both blooming at the same season, the pollen of one influences the other. Originally, the strawberries were grown only to get an additional revenue from the land, but the main object now is to impart that strawberry fragrance ("Le bouquet de fraise") so much appreciated by the gourmets. Although this interinfluence of pollens of widely different genera is considered impossible by scientists, it is nevertheless recognized that when weather or other conditions cause an abnormal interval between the blooming of the two genera, the wine lacks the strawberry fragrance and is not considered of "vintage" quality.

Last summer, it was my privilege to visit Monsieur Cochet, the fifth of a dynasty of French Rose scientists, at his estate of Coubert about 35 miles outside of Paris. During a discussion of various heredity phenomena among roses, M. Cochet asked me this question: "Do you believe that a rose plant, perfectly normal, could be induced by the vicinity of carnation plants in a closed frame to produce carnation blooms?"

About 15 years ago, a woman, owner of a neighboring chateau, came to him to ask that question which seemed to him ridiculous as it did to me, but after she showed him the rose plants in bloom, he admitted at least a "Curious coincidence".

M. Cochet has just published a paper in "Revue Horticole" which I have translated for the Journal of Heredity. I would like to hear comments and explanations of this teratologic phenomenon. The most unusual feature is that it was not *one* bud variation only but the variation occurred simultaneously on several plants. I saw the rose and it is exactly as described.

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## Rose Oeillet de Saint Arquey (Bengal) (Carnation Rose)

*Translated from Revue Horticole, September* 16, 1928

The carnation rose of Saint Arquey was found in 1912 at the Chateau of the Abbey of Saint Nicolas-aux-bois, near Saint Gobain (Aisne) belonging to M. Faure.

M. Vilfroy, then head gardener of the domaisne made in 1911 some cuttings of a horticultural variety of Rosa Chinensis (Jacquin) of which he did not retain the name.

These cuttings were placed in a cold frame containing also Carnation cuttings.

In 1912, Mme. Faure and M. Vilfroy noticed with surprise that by some strange coincidence several of the rose cuttings were bearing roses resembling exactly carnation blooms!

These cuttings were carefully preserved, the owners asked for my opinion as to the value of their new rose, and I declared it extremely interesting because of its absolutely unique form and coloring, nothing like it existing to my knowledge in genus Rosa.

Mme. Faure gave me some branches

**THE CARNATION ROSE**

**Figure 22**

A rose that bears flowers remarkably resembling a carnation. Several cuttings in a cold frame containing carnation cuttings simultaneously produced these curious flowers, a strange coincidence, at the very least!

of her new rose with the mission of putting it in commerce after having fixed by budding and severe selection, that curious teratologic variation. She gave it the name of "Rose Oeillet de Saint Arquey, the Abbey of Saint Nicolas-aux-Bois having formerly been under the invocation of Saint Arquey.

Since 1913, that is for 15 years, we have, Mme. Cochet and I, selected and budded each year so as to accentuate and definitely fix the characters that distinguished it from its forbears. No reversion has occurred for several years. "Oeillet de Saint Arquey" makes a spreading bush, with thin, intercrossed branches, reddish purple when young and green when ripe, with few thorns.

FOLIAGE is of five leaflets, those near the flower only three, oval pointed, the end one being very pointed, serration variable, always purple as is also the underside of young foliage.

PEDICEL firm, bearing as also the calyx, glandular hairs. Flowers are small, with sepals sometimes leafy.

FLOWERS small with bracteas at times leafy, are of variable colors often maroon or blood red, at times crimson red with a darker edge and center almost white shaded carmine. The *petals* small, are plicate, deeply serrated and fringed. The general aspect of the flower is of the carnation and not at all of the rose.

FLORESCENCE is singly or a few, prolonged, as in all Bengals, throughout the season.

The Societe Nationale d' Horticulture de France awarded this new rose a certificate of merit at its meeting of July 26th, 1928.

This rose is expected to be put in commerce in the Autumn, 1929.

*Cochet-Cochet.*

# A SOLANUM HYBRID

## Resulting from a Cross Between *S. Fendleri* and *S. Chacoense*

CHARLES F. CLARK

*Associate Horticulturist, Office of Horticultural Crops and Diseases, Bureau of Plant Industry, United States Department of Agriculture.*

THE first generation hybrid reported in this paper was obtained from a cross between *Solanum fendleri* Gray and *S. chacoense* Bitter, two wild species of potato belonging to the tuber-bearing section of the genus Solanum. These species are quite distinct in their chief characteristics. *S. fendleri*, which occurs in the northern part of the range for this group, including the southwestern part of the United States and extending down into Mexico, is a plant of medium height with slender stems, comparatively long internodes, awl-shaped calyx-lobes, blueish-purple corolla, rotate, with lobes as broad as long, 24 chromosomes, and small tubers which are free from bitter taste. *S. chacoense* occurs in Paraguay, near the southern end of the range of the tuber-bearing species of this genus. The plants are low, having thick stems with short internodes giving a rosette appearance when young, short calyx lobes, broad at base with obtuse or blunt-pointed tips, white corolla, star-shaped, with lobes longer than broad, 12 chromosomes, and medium-sized tubers with strong bitter taste.

Both of these species produce an abundance of pollen with nearly 100 per cent good grains which germinate well on an artificial medium of 1 per cent agar plus 15 per cent cane sugar[2]. They cross readily when *S. chacoense* is used as the pollen parent. None of the reciprocal crosses attempted by the writer have been successful.

Progenies previously grown from selfed seed of the parent species had shown the latter to be genetically pure for the characters tested. This was further indicated by the high degree of uniformity of the plants obtained in the $F_1$ generation of the cross. Because of the apparently complete sterility of the plants of this generation it was not possible to obtain the $F_2$ generation.

The dominance of several characters was well defined in the $F_1$ generation. The visible expression of the most important of these is recorded in tabular form in Table 1.

### Dominance of Certain Characters In the $F_1$ Generation

The stem characters studied were length and thickness of the internodes, color and pubescence. Beginning with the early stages of development, the habit of growth of the plants of the two parent species is quite distinct. In *Solanum fendleri* a leafy stem is produced with long, slender internodes which give the plant a vinelike appearance during its later stages of growth. In *S. chacoense* the length of the internodes is very much reduced so that the young plants consist of but little more than a rosette of leaves. Although there is some elongation of the internodes during the development of the plants, they remain short as well as much thickened in comparison with those of the other parent species. The habit of growth in the $F_1$ hybrid is like that in *S. fendleri*, thus indicating the dominance of the characters which determine length and thickness of the internodes.

A comparison of the colors of the stems of the parents and hybrid shows the dominance of pigmented color over green chlorophyl color, the stem color of the hybrid being identical with the reddish purple* color of *Solanum*

*Corresponds to Ridgeway's[1] dull Indian purple. Pl. XLIV, 69", i.

**VIGOR OF SOLANUM HYBRID**

**Figure 23**

Parents and $F_1$ hybrid of a cross between *Solanum fendleri* and *S. chacoense*. The parent species are shown at the left, *S. chacoense* below and *S. fendleri* above. The hybrid is twice as tall as the parent species and it matures much later.

*fendleri* rather than the green color of *S. chacoense*.

The stems as well as the leaflets of *Solanum fendleri* are covered with short, pointed, hyaline hairs which are curved, giving a partially appressed appearance. *S. chacoense* is practically free from pubescence, although occasionally a plant will be found bearing a few minute hairs which can be seen with the aid of a hand lens. The pubescence of the $F_1$ plants, although slightly less abundant, is of the same character as that of *S. fendleri*.

The calyx lobes of the hybrid are not identical with those of either parent, although there is a well-defined tendency toward dominance of the narrow, pointed type which prevails in *Solanum fendleri*.

Of the three characters of the corolla which were studied the lobelia violet† color, the rotate shape of the corolla, and the broad corolla lobes of *Solanum fendleri* were dominant over the white color, star-shaped corolla, and narrow corolla lobes of *S. chacoense*. The color of the corolla, however, was slightly diluted in the $F_1$ hybrid, being designated as pale lobelia violet‡.

The tubers of the parent species differ somewhat in size. The average length of those of *Solanum fendleri*, as grown in pots in the greenhouse, approximated 20 mm. and the width 17 mm., whereas similar dimensions of the tubers of *S. chacoense* centered around 30 mm. and 32 mm., respectively. Because of the excessive vegetative growth of the $F_1$ hybrid the plants had not reached maturity at the time it was necessary to harvest them, which was during the early part of October, when both the parent species were mature or nearly so; consequently, no opportunity was offered to determine the size of the tubers at full maturity. They had, however, attained a size sufficiently large to indicate the dominance of this characteristic of *S. chacoense*.

Another instance of dominance in tuber characters is that of the sharp, bitter taste of the flesh which is present in both *Solanum chacoense* and the $F_1$ hybrid while it is entirely absent from *S. fendleri*.

## Hybrid Vigor

The vigor of the hybrids in the $F_1$ generation was very outstanding. The

**TABLE I—Characters Showing Dominance in a Cross Between Solanum fendleri, Gray and S. chacoense Bitter.**

| | *Expression of characters in parents and progeny* | | |
|---|---|---|---|
| *Characters* | *S. fendleri* | *S. chacoense* | *$F_1$ hybrid* |
| Habit of growth | Early leaves scattered | Early leaves rosetted | Early leaves scattered |
| Stem color | Dull Indian purple* | Green except at nodes | Dull Indian purple* |
| Stem pubescence | Pubescent | Glabrous | Pubescent |
| Leaflet pubescence | Pubescent | Glabrous | Pubescent |
| Calyx-lobe shape | Narrow; short awl-shaped | Broad; obtuse or blunt pointed | Narrow; acuminate |
| Corolla color | Lobelia violet† | White | Pale lobelia violet‡ |
| Corolla shape | Rotate | Star-shaped | Rotate |
| Corolla-lobe shape | As broad as long | Longer than broad | As broad as long |
| Tuber size | Small | Medium | Medium |
| Tuber taste | Not bitter | Bitter | Bitter |

*Corresponds to Ridgeway's[1] dull Indian purple. Pl. XLIV, 69‴, i.

†Ridgeway,[1] Pl. XXXVII, 61″, b.

‡Ridgeway[1], Pl. XXXVII, 61″, f.

young seedlings grew very rapidly, developing into plants which were nearly twice the height of the taller parent, *Solanum fendleri*. (Figure 23). After the blooming stage was reached they flowered profusely and continued to do so until harvested, at which time they showed no signs of maturity.

### Sterility

The anthers of the $F_1$ hybrid are normally developed and produce pollen in fairly abundant quantities. Microscopic examination of the pollen grains showed practically all of them to be sterile. Only very rarely was a plump pollen grain with granular contents seen. Pollination of pistils with pollen from the same flower clusters resulted in failure to produce seed balls. The absence of fruit production also followed the pollination of the hybrid plants with pollen from *S. fendleri*, one of the parent species. When pollen from the other parent, *S. chacoense*, was used, a few small fruits without seeds were formed. These, however, dropped off before they had reached half the normal size. It is apparent that a very high degree of both male and female sterility exists in this hybrid.


### Summary

The $F_1$ generation of a cross between *Solanum fendleri* Gray and *S. chacoense* Bitter was obtained, the latter species being the pollen parent. The reciprocal cross failed to produce fruit.

Dominance was exhibited in the following characters: Habit of growth, color and pubescence of stems, pubescense of leaflets, shape of calyx-lobes, color and shape of corolla, shape of corolla-lobes, and size and taste of the tubers.

Hybrid vigor was very clearly shown in the large, vigorous growth of the hybrid plants.

The evidence obtained from a microscopic examination of the pollen and from pollination with the plant's own pollen, as well as with the pollen of both parents, indicates that a high degree of sterility exists in both the male and female germ cells.


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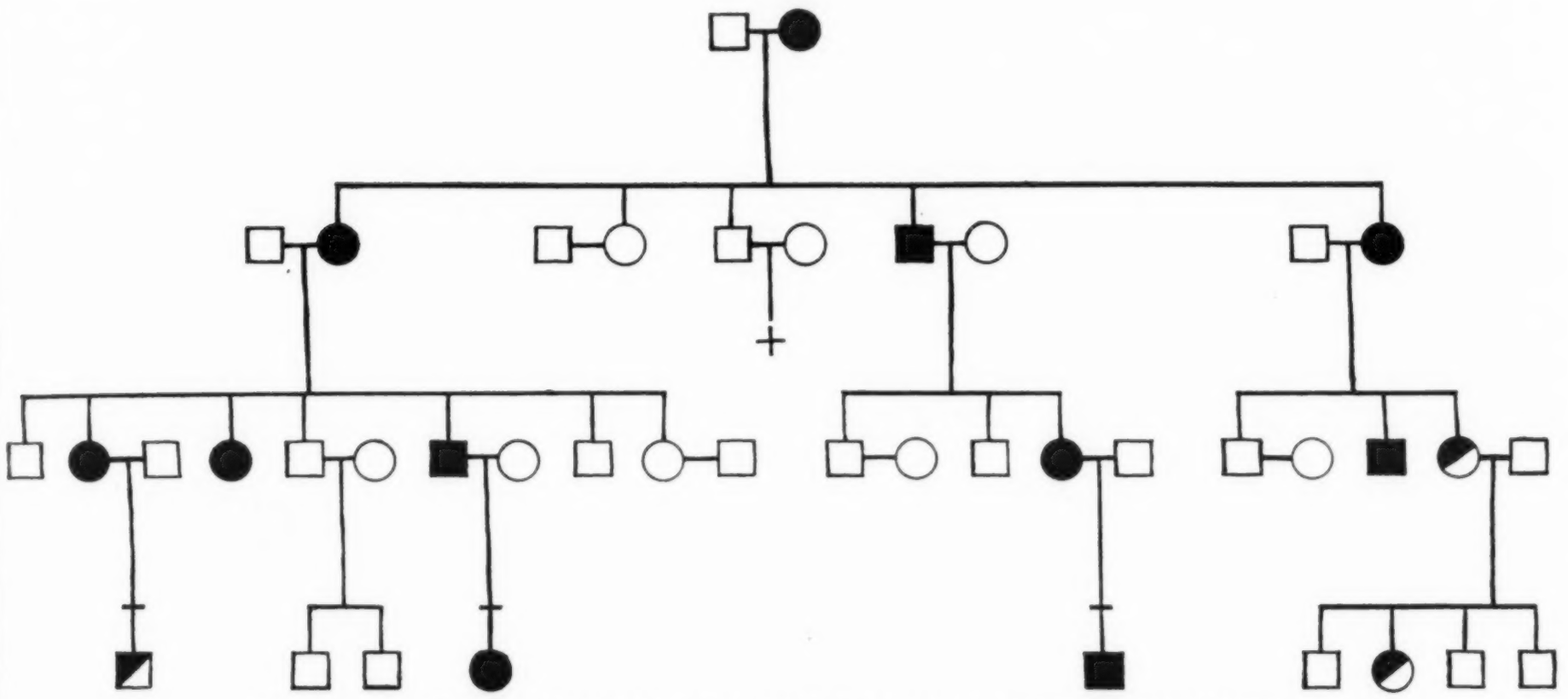
# INHERITANCE OF CROOKED LITTLE FINGERS

## (Streblomicrodactyly)

R. A. HEFNER*

*Miami University, Oxford, Ohio*



**FOUR GENERATIONS OF CROOKED LITTLE FINGERS**

**Figure 24**

Solid black symbols indicate individuals with both little fingers affected; half-black symbols indicate only one finger affected. A dominant inheritance is indicated.

A PREVIOUS description[4] of the inheritance of crooked little fingers was concluded with this remark, "The application of a definite nomenclature to this condition awaits further report on its prevalence, mode of transmission, and specific nature". The location of an additional record of this anomaly, extending over four generations (Figure 24), would now seem to justify the application of a definite term. The word *Streblomicrodactyly* (*Strebles*—bent + *micros dactylos*—little finger) is coined for genetic reference to this condition.

Streblomicrodactyly is characterized by the inability to extend completely one or both little fingers in the region of the proximal phalangeal joint (Figure 26). It is the opinion of the writer that the primary cause of the anomaly is an abnormal shortness of the flexor tendon which attaches to the middle phalanx of the affected little finger. The real inheritance is thus a muscular or connective tissue anomaly but the expression of the character would suggest a bone defect. The bending of the distal end of the proximal phalanx observed in a previous description of this anomaly[4] is now interpreted as a result of the congenitally short tendon.

### Case Histories

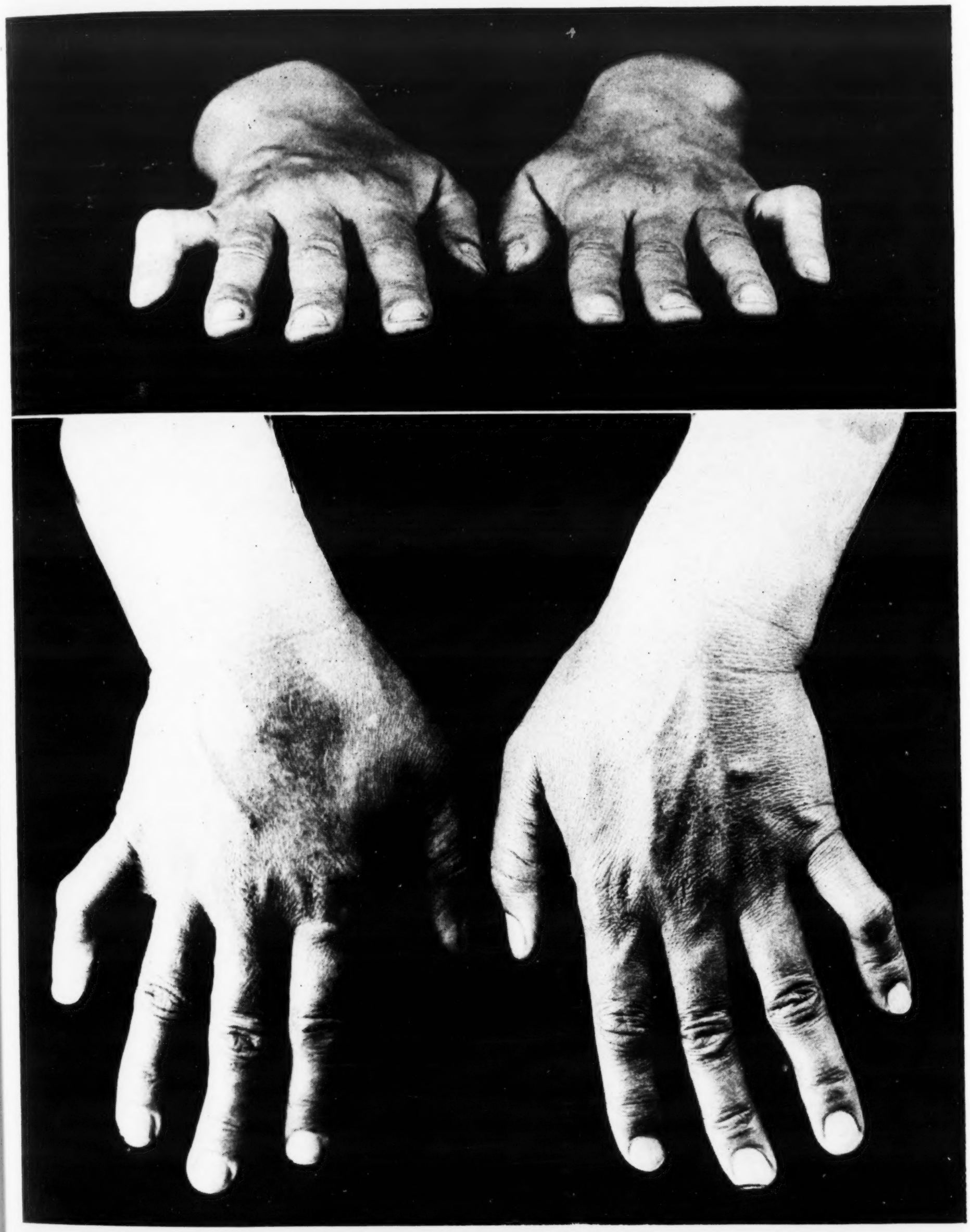
*Case I.*—Streblomicrodactyly exhibited in the right hand of the male parent and in both hands of a son. This brief record was the subject of a previous report[4].

*The writer desires to acknowledge his indebtedness to Miss Ethel McDougle for the data relating to Case II of this report, and to Mrs. E. M. Miller for assistance in the application of the Greek derivations of the terminology employed.

**X-RAY VIEW OF THE BENT LITTLE FINGERS**

**Figure 25**

The bones appear normal and the condition seems to be due to a shortening of the tendon attached to the palmar side of the middle phalanx of the little finger.



The bones appear normal and the condition seems to be due to a shortening of the tendon attached to the palmar side of the middle phalanx of the little finger.

## ONLY THE LITTLE FINGERS BENT

**Figure 26**

The other fingers can be straightened normally, but the little fingers remain bent. The peculiarity has been inherited for at least four generations.

*Case II.*—Streblomicrodactyly in one or both hands of fourteen members of a family line extending over four generations (Figure 24). The unilateral and bilateral expression of the trait seems to occur at random. The photographs and radiographs of the hands of one individual from this family show a marked similarity to the examples presented in the first case history. A comparison of the number of individuals affected (13) to the normal individuals in the same families (12) leads to the conclusion that streblomicrodactly is inherited as a mendelian dominant characteristic.

## Discussion

The attempt to apply a definite nomenclature to human hereditary characteristics has recently invoked criticism through the German press. Hoffman[5] contends that the genetic terms brachydactyly[1], minor brachydactyly[2], and brachymegalodactyly[3] all refer to *brachyphalangie*, a general term proposed by Pfitzner[6] in 1898. On the other hand, Pfitzner's term is a general one and is wholly inapplicable to the several types of inheritance to which the former terms apply. A parallel case in the genetics of the fruit fly, *Drosophila melanogaster*, may be cited. Here the appearance of congenital short wings is designated as three separate unit characters, miniature, dumpy, and vestigial, each of which has a distinct and characteristic mode of inheritance. The application of specific genetic terms is not affected by or correlated with any general anatomical description applying to many separate characteristics.

Streblomicrodactyly may thus be described as a mendelian dominant, human hereditary characteristic which is caused by a congenital shortness of the branch of the flexor digitorum ligament leading to the middle phalanx of the little finger. In appearance, the anomaly is observed as a crooking of the little finger when all other manual digits are extended.

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